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SCIENCE ON THE MARCH
UNIT FIVE

668A

HEALTH

SENIOR BASIC TRAINING COLLEGE
BANIPUR

12/15

Vera Elkan

SCIENCE ON THE MARCH

UNIT FIVE

HEALTH

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The first nine units of SCIENCE ON THE MARCH are:

1. Air and You.
2. Water and Life.
3. The Weather and the Earth.
4. Life and Food.
5. Health.
6. Energy and Engines.
7. Hearing and Seeing.
8. Electric Currents.
9. Magnets and Motors.

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SENIOR BASIC TRAINING COLLEGE
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Review Questions on Unit 80

DANGEROUS TO LIFE! Both the tiger and the crocodile look dangerous, but they are large enough to be seen if you are quick enough!

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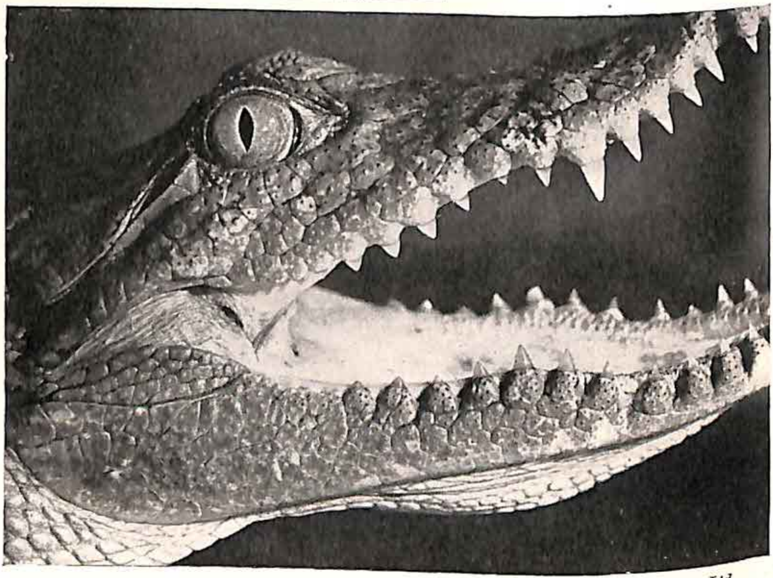

The mosquito below is really only one-fifteenth the size of its picture, and the bacteria have been enlarged 30,000 times: but both are far more dangerous to human life than the tiger and the crocodile.

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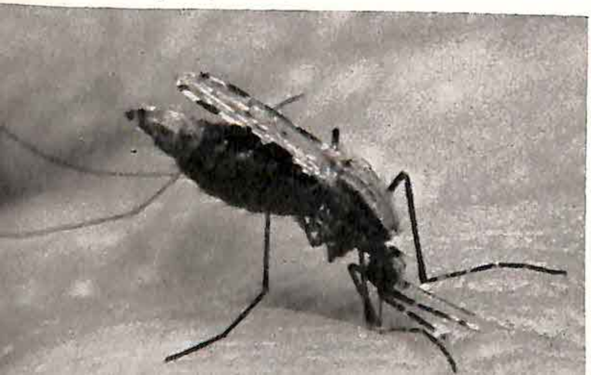

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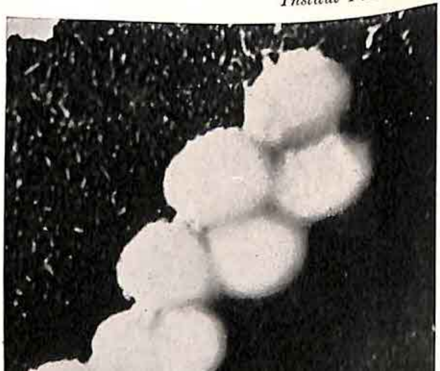


Health

Look at the photographs opposite. Which things there are most dangerous to health and life? At the top you see a tiger which might eat you—if it had the chance. At the bottom right is a photograph of living things so minute that they can only be seen through powerful lenses. The scientific name for them is *bacteria* but people commonly speak of them as "germs." As the word "germ" has several possible meanings, it is best for us to use the word "bacteria." This photograph of the bacteria was taken by an electron microscope and shows the bacteria 30,000 times their natural size.

Not all bacteria are harmful; indeed most bacteria are beneficial in some way or other and a few kinds that live in the human body actually promote health. But as we do not often have to do anything about the beneficial bacteria, we usually start thinking about disease when we hear somebody talk about "germs." Actually there are some bacteria which are so harmful that if they can get into a human body in large numbers they can destroy it as surely as would a tiger or a crocodile.

When you stop to think about it, you do not have to worry very much about tigers, or, for that matter, lions, crocodiles, bears and other large animals that might attack you. Men have many good weapons that can be used against such enemies. As a result tigers survive only in wild regions which are thinly settled. How different it is in the case of harmful bacteria! Little foes of this kind are likely to be on us, in us and about us at all times. We cannot see them without very powerful microscopes and we cannot hope to kill them all. They are among the really dangerous enemies of mankind and some of them should be feared much more than tigers are by the inhabitants of isolated villages in India.

Very few people in India get eaten by tigers, but many millions of children and of quite young men and women die in India every year as a result of the work of bacteria.

But bacteria are not the only causes of disease, as we shall shortly see. Lack of food, ignorance regarding the right foods to eat, unwise habits which are not in keeping with Nature's laws, all play a great part in creating illness all over the world. So do alcohol, excessive smoking and addiction to drugs.

And so also do certain kinds of work, such as mining under conditions in which fine sand gets into the lungs, or working in factories where dangerous chemical fumes are continually inhaled. Nowadays in most countries great care is being taken to reduce the risks of workers in mines and factories. But in days gone by many hundreds of thousands of people died young as a result of the conditions under which they had to work. The factory owners were not wholly to blame because the causes of most of the illnesses in those days were not known, and scientists had not then found ways of making factories more hygienic and less dangerous places.

In this Unit you will learn about ways in which we may all help to look after the health of others as well as of ourselves.

Problem A: **WHAT ARE THE ENEMIES OF HEALTH?**

IN THE DAYS OF LONG AGO

In the Middle Ages there were almost no scientists; people believed that diseases were mainly a punishment for sin. In those days most children died young and the average length of life for a human being was small: some historians put it at about twenty years.

Practically all the old cities and towns were insanitary and often so filthy that they became hotbeds of disease. People in the country were somewhat safer, partly because their houses were not so crowded together and partly because they had more fresh air and sunshine. Many diseases can be passed to others in the breath of the infected person. One example is the disease which we call tuberculosis and which used to be called "consumption" and was spoken of as the "white plague." In this case it is bacteria which are breathed out that cause the damage to others.

But many other diseases are caused by bacteria in dirt which gets into cuts and sores. For instance in the old days the dirty hands and clothes of the surgeon often brought to the unfortunate patient the bacteria of blood-poisoning and so the patient died a few days after the painful operation.

But until less than 200 years ago doctors really knew very little indeed about the causes of disease. Most people had all sorts of superstitious notions, such as that plagues were caused by an eclipse of the moon or by two planets appearing unusually near to one another.

One of the ways in which doctors used to try to cure people of certain diseases was by blood-letting. This was usually done by barbers (why barbers?), who accordingly were known as "barber-surgeons." Have

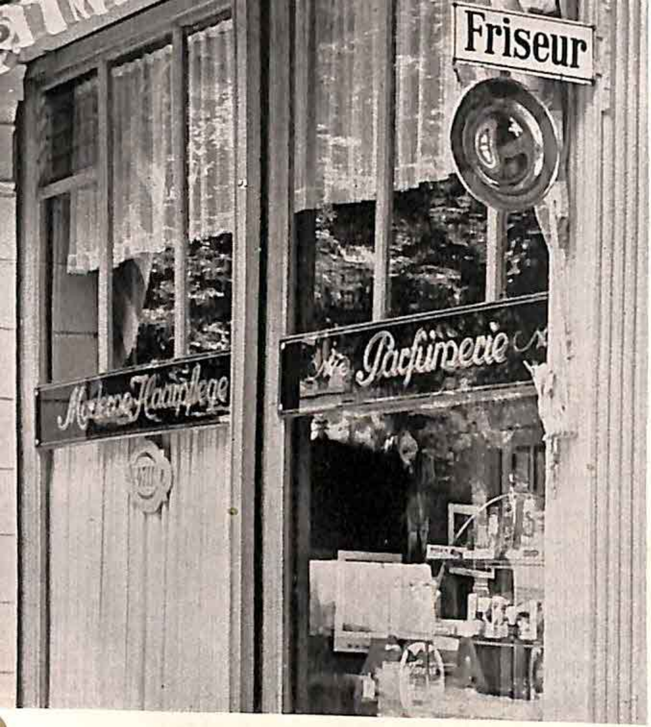


FIGURE 2. Here you see the old sign of the barber surgeons — the metal dish which, pressed against the arm, caught the blood when the patient was bled for his health. This sign is common outside hairdressers' shops in many parts of Europe.

E. Heimann

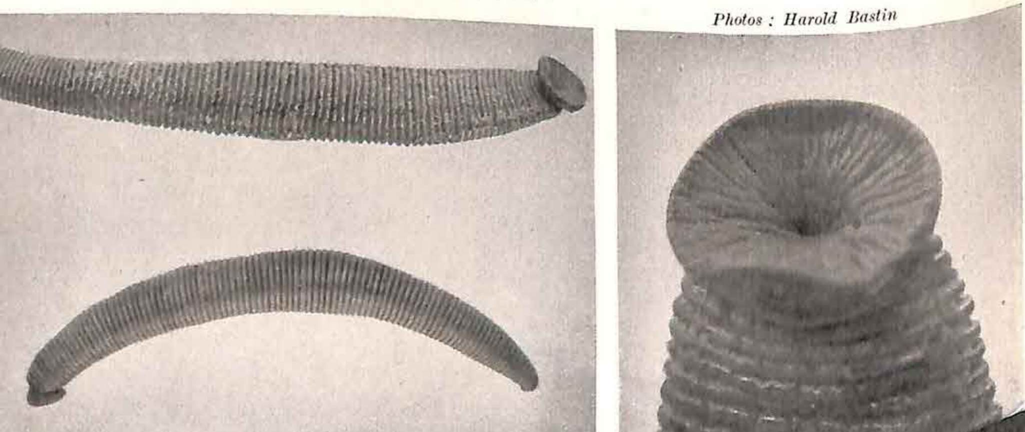
you seen the barbers' signs which show the connection with blood-letting hanging outside their shops ?

Another way of removing blood from sick people was to put leeches on their limbs and to let the leeches suck blood from the patient. Today such blood-letting treatment is seldom used.

Why is the treatment of disease so different today ? You will find some of the reasons by answering the following questions.

FIGURE 3. Here are two leeches. They are about 2 inches long. On the right is a larger photograph of the mouth. It is about ¼ inch wide. For what were leeches used ?

Photos : Harold Bastin



Question 1. **What are Bacteria ?**

Look at Figure 4. Compare it with the photographs of bacteria. Can you see any resemblances ? This picture is a copy of drawings made nearly 300 years ago by a Dutch scientist who had made for himself a very powerful lens. It was a long time before anyone else obtained magnification strong enough to show bacteria as this Dutchman saw them.

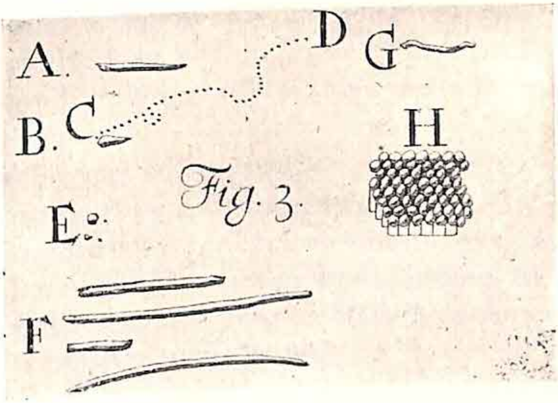


FIGURE 4. The first drawings of bacteria. They appeared in a publication of the Royal Society of London in 1683 and were made by a Dutch scientist, Leeuwenhoek.

From Singer, "Short History of Medicine" (O.U.P.)

Each bacterium consists of only one cell. There are so many kinds of bacteria, and the study of them is so big a task, that there is now a science on its own called *bacteriology*. The Greek word *logos* means *study*, so you can see exactly what this word *bacteriology* means.

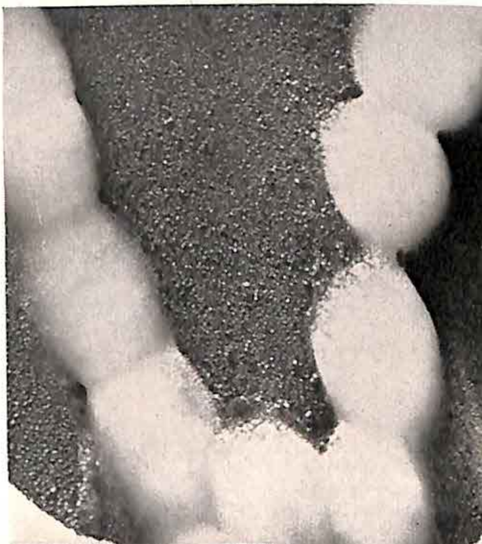


FIGURE 5. Some more bacteria, shown 27,000 times their real size. These bacteria are called *streptococci* : *cocci* means grains and *strepto-* shows that they are usually found in chains.

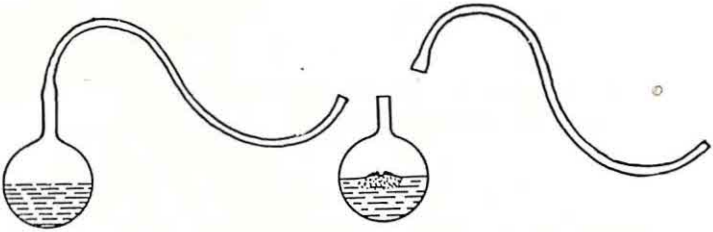
Institut Pasteur

When bacteria find a suitable situation in which they can absorb food through the wall of their cell (for instance, if disease bacteria have got into the blood of an animal) they begin to multiply. This they do by splitting into two, and into two again and so on, and they can sometimes multiply themselves by two in a matter of minutes. A few minutes later there will be four and a few minutes later—sixteen. How many bacteria would there be from one bacterium which has multiplied itself by 2, twenty times ?

Of course bacteria do not usually have things their own way when they are in the blood of an animal. Generally, the blood, as it were, fights back. But what happens to the bacteria if the animal dies ? Do they die too ?

In some cases this may be so, but in the case of a dreadful disease of cattle, called anthrax, this is not so. Bacteria that get from the animal on to the ground form a tough coat around their microscopic cells and can stay in this resting form for months, even years, without ceasing to be alive. Being very very small they can be blown by the gentlest breeze and may get into a cut in the skin of a healthy cow or bullock and the disease then starts again. This resting stage of a bacterium is called a *spore*.

It is because air almost always contains bacteria, and spores of bacteria, and spores of moulds, that foods exposed to the air can go bad and wines can turn to vinegar and so on. For bacteria are some of the chief causes of decay and of rotting, or " putrefying " as it is often called. It was only through this action of bacteria that a clever Frenchman, Louis Pasteur, was able to convince the world firstly that bacteria really exist and secondly that they are the cause of many diseases. This was less than 100 years ago.



From Singer, "Short History of Medicine" (O.U.P.)

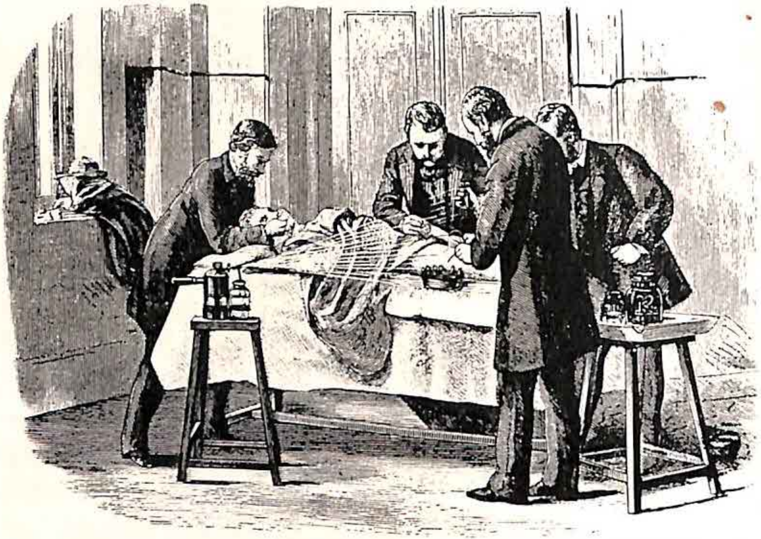
FIGURE 6. Pasteur's convincing proof that putrefaction is due to living particles present in the air.

Look at Figure 6. The flask with the S-shaped neck contains a liquid such as meat broth, which readily goes bad. The flask is heated so that the liquid boils and any living microbes in the flask or its neck are killed. Pasteur showed that this flask can now be left for months, even years, with the end of the neck open, but without the broth inside going bad. This is because any bacteria, or spores of bacteria, or spores of moulds, which are present in the air fall on the floor of the curved neck and stay there.

But if the neck be cut, so that these tiny living things can fall directly on the fluid, then in a few hours putrefaction starts, and a drop of the fluid, seen under the microscope, is found to be full of tiny forms of life.

One of the ways in which bacteria become most dangerous is by entering a cut or wound. That is why so many people used to die after operations. Before Pasteur had taught people how bacteria act, and how harmful they can be, no one could know that when an operation takes place the cut part must be protected against utterly invisible microscopic particles which are in the air and on the hands and clothes of the surgeons. Accordingly a great proportion of wounds used to putrefy, or turn "septic" as we more politely express it. (But the word *septic* comes from a Greek word which means "to putrefy.")

Look at Figure 7 which shows how operations used to take place until fairly late in the nineteenth century. Could you suggest improvements?



Wellcome Historical Medical Museum

FIGURE 7. Carbolic acid is being sprayed into the air in this picture of an operation less than 100 years ago. This was a great step forward in making operations less dangerous to the patient by avoiding infection of the wound by bacteria.

It was a Scottish doctor, Lister, who first thought of killing all the bacteria around the wound when an operation was taking place. The ideas came to his mind when he reflected on Pasteur's discoveries. Lister realized that if something could be done to kill the bacteria in the air around the part of the body which was being operated upon, this would have a protective effect. If also he could kill the bacteria on the hands of the surgeon and in the wound itself, then proper healing ought to take place. So he used a

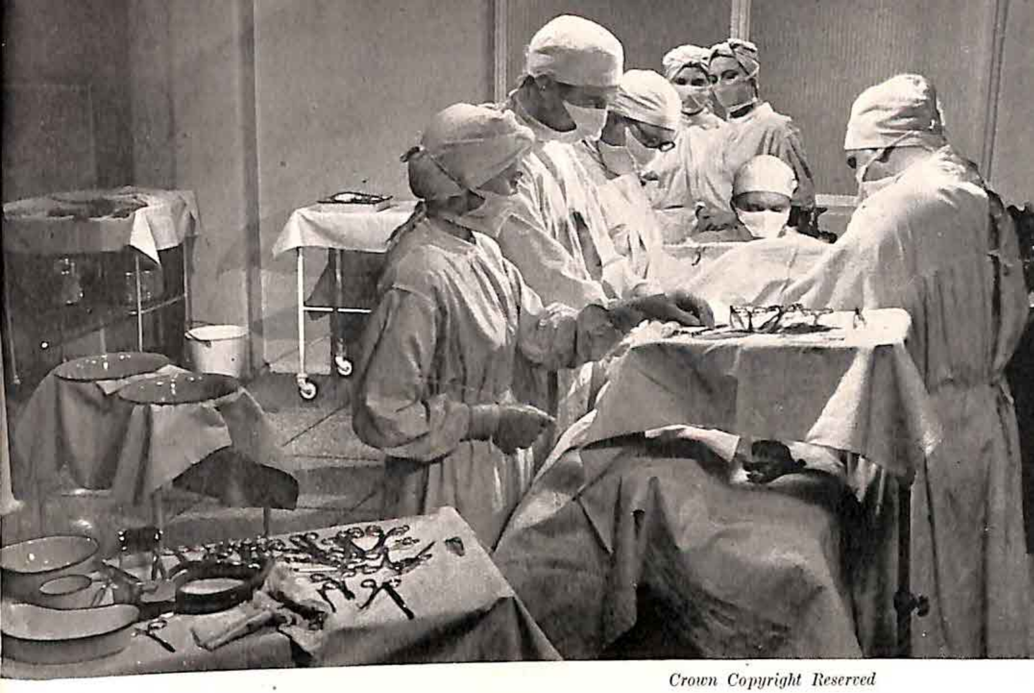


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FIGURE 8. An operation today. Compare it with Figure 7 and state all the precautions taken nowadays which even Lister did not take.

"Donkey engine," worked by hand, to spray carbolic acid into the air near the wound. So carbolic acid became the first *anti-septic*. Can you see what this word means?

Nowadays all operations are conducted under conditions which, as far as possible, prevent any bacteria from getting near the wound. Look at Figure 8. Why do the surgeon and the nurses wear masks? What do you think has been done to the rubber gloves and the white coats before they are worn? And what do you think has been done with the surgeon's instruments to make sure that they do not convey any bacteria? Things that have been so treated that all bacteria are killed are said to be *sterile*. This means that they are completely barren of any living things, however small.

SOME THINGS YOU MAY CARE TO DO

1. Make a collection of drawings of different kinds of bacteria and viruses by copying pictures that you can find in books. Don't forget to say how many times bigger your diagram is than the actual size of the bacteria and viruses.

2. Read up the life of Louis Pasteur and be ready to give a talk on his life and work.

3. It is possible to perform an experiment very much like that of Pasteur with very simple apparatus. Obtain two identical glass ink bottles with wide shoulders. When both are clean and dry, pour into them equal quantities of meat broth, to a depth of about half an inch. Put both bottles in the oven and *gradually* heat them until the gravy begins to boil. (If you heat too quickly, the thick glass will split.) While you are waiting for the gravy to boil, wrap round the tip of the closed blades of a pair of scissors a plug of cotton wool such as will fairly tightly fill the neck of one of the ink bottles. When the gravy has boiled for about half a minute remove both bottles from the oven. Take the cotton wool on the scissors and wave it in a flame to sterilize it. As it catches fire push it into the neck of one of the ink bottles so as to plug the neck.

Then put both bottles side by side on a table or shelf and leave them undisturbed for a few days, one with the neck plugged, the other with the neck open. Observe daily : when the gravy in the bottle with the open neck is obviously putrefying, remove the plug from the other bottle and compare the smells of the two bottles and the conditions of the contents. Can you explain why the liquid in one bottle has not putrefied, even though air can pass to and fro through cotton wool ?

Question 2. **What are Viruses?**

Recently scientists have discovered some living things, which, believe it or not, are very much smaller than bacteria. These are called *viruses*, from a Latin word which means a *poison*.

The story of the discovery of viruses is an exciting one. About thirty years ago some doctors discovered that when people and animals suffer from certain diseases no bacteria to account for the illness can be found in their bodies. Yet they were able to prove that *something* to cause the disease was present in the bodies of the sick animals. For instance they found that if they took clear filtered fluid from the crushed brain of a ferret which had died of dog distemper and put some into the body of another ferret, this second ferret would also develop dog distemper. And because dog distemper is always fatal to ferrets this second ferret would also die. So it was firmly proved that this clear fluid, which seemed to contain nothing at all, not even bacteria, did contain something which passed on the disease.

For years scientists all over the world searched such fluids with their best microscopes, but still they could not find anything which they could see or photograph in these fluids. So they called them "poisons" but used the Latin name for poison in order to show that these must be a special sort of poison.

The invention of the electron microscope has changed the situation, for it has enabled us to photograph particles which are far too small to see with the human eye even if it uses the most powerful microscope.

Look at Figure 9. It shows one bacterium and lots of small round things which are virus bodies of a

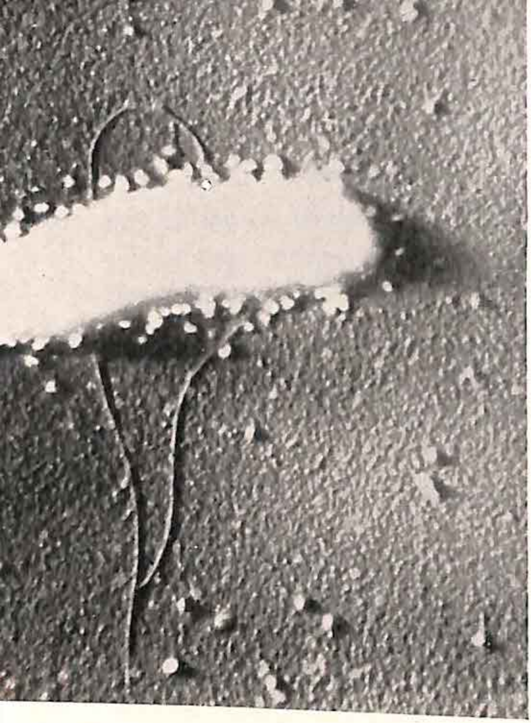

FIGURE 9. This photograph, through an electron microscope, shows one bacterium and many virus bodies 23,000 times their real size.

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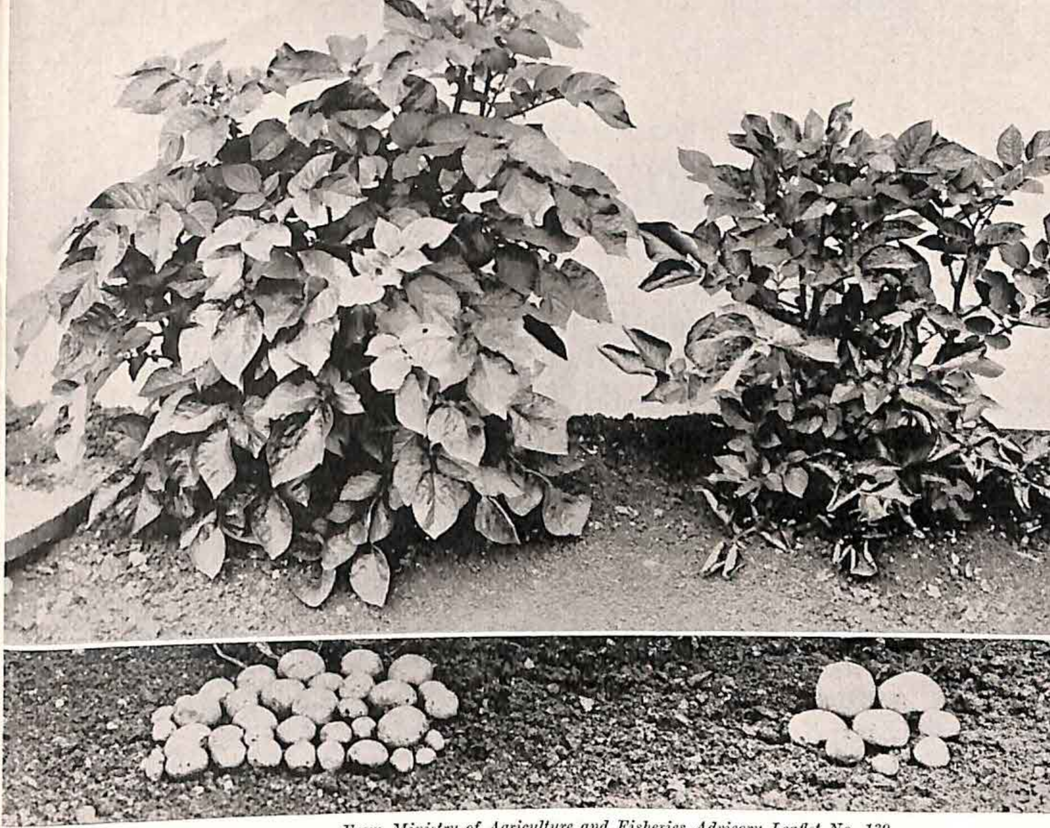
kind that attack certain bacteria. So you see that even bacteria have their natural enemies and that there is a certain amount of truth in the rhyme, written more than a hundred years ago :

Big fleas have little fleas
Upon their backs to bite 'em ;
And little fleas have lesser fleas,
And so *ad infinitum.*

But while some viruses may destroy bacteria a great number of them are very harmful and are the cause of diseases of both plants and animals.

Look at Figure 10 which shows you what a difference a particular virus disease makes to a crop of potatoes. Obviously if men can learn to control virus diseases of plants, this will make an immense difference to the world's food supply. At present, however, we do not know very much about viruses, but scientists all over



*From Ministry of Agriculture and Fisheries Advisory Leaflet No. 139.
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FIGURE 10. Viruses can give diseases to plants as well as to animals. On the left is a healthy potato plant and underneath it you can see the fine crop of potatoes it produced. The plant on the right has been attacked by a virus disease called Leaf Roll. Compare the leaves, the growth, and the crop, in the two plants.

the world are at work upon them. Viruses are known to be the cause of a number of human diseases, including probably measles, mumps, and yellow fever. Viruses play a part too in colds and influenza.

SOMETHING YOU MAY CARE TO DO

Keep on the look-out for new information about harmful viruses and how to cope with them. You may find facts in newspapers, illustrated magazines, and weekly papers on gardening. Paste the cuttings into a special book. Always record the name and date of the periodical from which the cutting is taken.

Question 3. **Are there other causes of Disease ?**

We have only to think about food in order to remind ourselves that wrong food, or too much of it, can make us ill. Indeed some serious diseases may be caused by constantly eating foods which are too rich in fat or protein. But far more people suffer from not having enough food to eat or through eating foods which are lacking in proteins or in the right vitamins. Indeed there must be few countries, if any, where the majority of the people are having a diet which satisfies all the demands of nature for the right amounts of the right vitamins and of body-building foods and energy foods and minerals. It has been estimated that more than half of the people of the world are under-nourished. Can you name lands where under-nourishment is particularly bad ?

You have probably read about vitamin C and sailors and scurvy in Unit One. Do you remember which vitamin is required to cure or prevent the disease called beriberi which used to be common in the Far East ? Which vitamin is required for proper development of the bones, so that children do not grow up with bow-legs or other troubles, through the disease called rickets ? Perhaps you have never seen bow-legged children, but, when one of the writers of this book was a child in London, children with bow legs were quite common, especially in districts where people were poor. What does this tell you about their food ?

In Unit Four you learned which foods are richest in the most important vitamins. Can you name two foods which are rich in vitamin B and a vegetable which is rich in vitamin A ?

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ANIMAL PARASITES

Some diseases, especially in tropical countries, are caused by animals which live inside the human body. Such animals are said to be internal *parasites*. The word *parasite* first meant a person who, by flattering wealthy people, got himself invited to their meal table. Can you see why the name can be applied not only to animals that live *inside* another body but also to those that live *on* the body but outside ? Examples are fleas that live in the coat of a dog, or lice that live between the spines of a hedgehog, or lice that live in human hair. Can you think of others ? Is it right in any way to say that young children are parasites of their parents ?

The animals that are internal parasites of the human body may be microscopic—like those that cause malaria and dysentery. Or they may be several inches long—like the round-worms that can live in the human intestine, or even some yards in length—like the flat tape-worm that can also live in the human intestine.

Happily such infections are rare in countries that are up-to-date in their food laws, in their sanitation, and in their health system. But animals in such countries are often not free from internal parasites. For instance you yourself have probably known of dogs which were suffering from round-worms inside their bodies.

External parasites, like fleas and mites, are always a nuisance to their hosts through irritation caused by their bites. But they can be much more harmful when they infect the blood of their host with bacteria or viruses. Not only parasites do this, but a whole range of biting insects. And other insects convey bacteria to our food. So we had now better give insects a special section to themselves.

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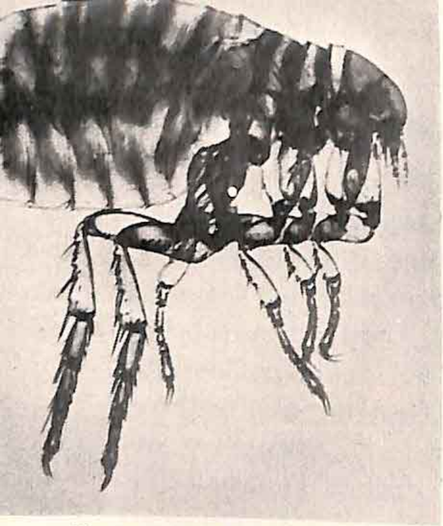

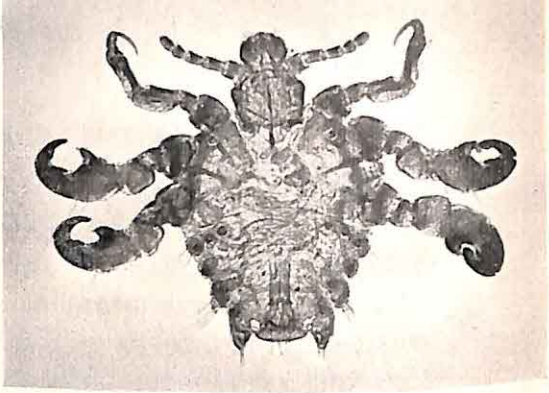

FIGURE 12. Another human parasite: the louse. Why is it so difficult to detach from the skin?

Photos: Douglas F. Lawson

FIGURE 11. A flea that is a human parasite. This photograph shows it 63 times larger than life. This is a male flea; the female flea is only half the size.

SOME THINGS YOU MAY CARE TO DO

1. Prepare a talk for your class on the world shortage of food and the work of the Food and Agricultural Organization. Probably your local branch of the United Nations Association can borrow books and pamphlets for you from the U.N.A. central library. Or your local public library may be able to help.

2. Prepare a talk on the World Health Organization and tell what it is doing to improve the conditions of people (*a*) in backward parts of the world, (*b*) among the nations which are scientifically more advanced.

3. Visit a museum and see if you can find large pictures or models of external animal parasites such as fleas, lice, mites and ticks. Find out how these parasites manage to pierce the skin of their host.

4. In a museum look for specimens (generally in bottles) of tape-worms, round-worms and other internal parasites that can be seen without a microscope. Try to find out how a tape-worm fixes itself inside the human intestine.

Question 4. How do Insects bring Disease?

Almost everyone has been bitten by insects. Among them are the many varieties of mosquito. Figure 13 may perhaps recall some unpleasant incident to your mind. Mosquito bites itch, burn, swell and sometimes cause people to cough. But people who live or travel in warm climates have often much more serious reasons for avoiding mosquito bites, as you will see.

You may be able to look at a chart or a film strip which shows the life history of a mosquito. Note how the eggs are laid on the water. The young live in the water (fresh or salt), but they must come to the surface to get air.

At the moment when adult mosquitoes first become active, their wings must have two or three minutes in which to dry, or otherwise they cannot leave the water. If the surface of the water is moving about, the wings are not likely to dry. Can you now see two reasons why mosquitoes breed in stagnant water in pools, water butts and so on, rather than in swiftly moving streams or large lakes where the wind makes waves?

If you are able to visit a pond, collect a jar of the water and other materials from some shallow place. Before you dip your jar remember to move quietly and to choose a spot where your shadow is not thrown over the water as you approach. Otherwise mosquito larvae

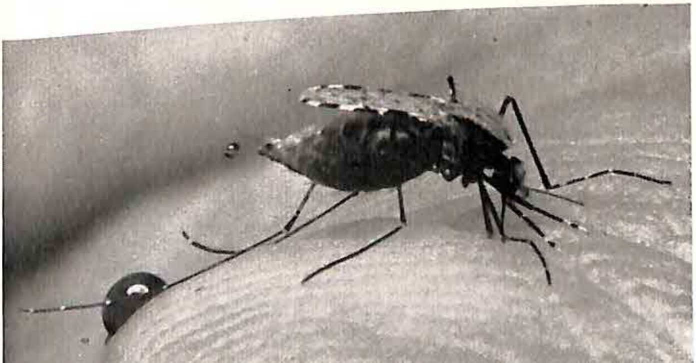

FIGURE 13. A mosquito biting its victim.

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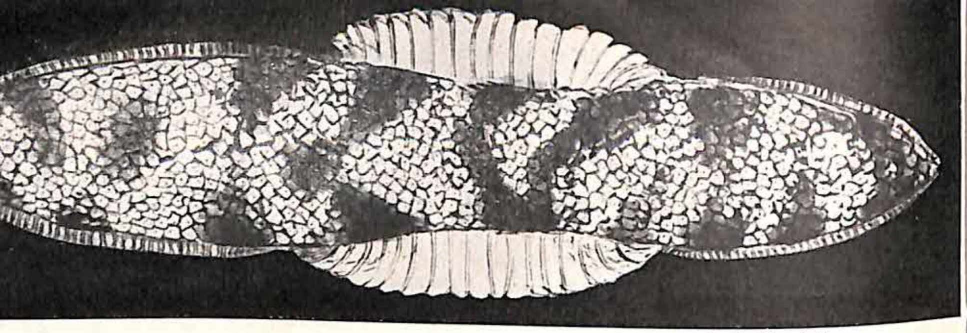


J. F. Marshall

FIGURE 14. A mosquito egg, magnified 300 times.

will rush to the mud at the bottom of the water. When you have got your jar of material let the mud and other things settle in the jar, and see if any young mosquitoes are present.

Can you describe the way in which the larvae of mosquitoes move? Do you know the two different ways in which different kinds of mosquitoes lay their eggs?

INSECTS AND DISEASE

Mosquitoes and disease. Male mosquitoes do not bite at all and some kinds of male mosquitoes can be recognized by their long bushy antennae even when they are in flight. Only female mosquitoes suck blood; they need this rich food so as to make the eggs which they lay. In order to make the blood flow easily while they suck, they inject some fluid into the hole which they pierce in the skin. It is this fluid which causes the irritation and the swelling.

Some kinds of mosquito-bite are merely annoying, but if, along with the fluid, the female mosquito injects the microscopic parasites of malaria or the still smaller virus of the still more dangerous disease, yellow fever, then the mosquito bite is a very grave matter. Mosquitoes which are infected with malaria are common in

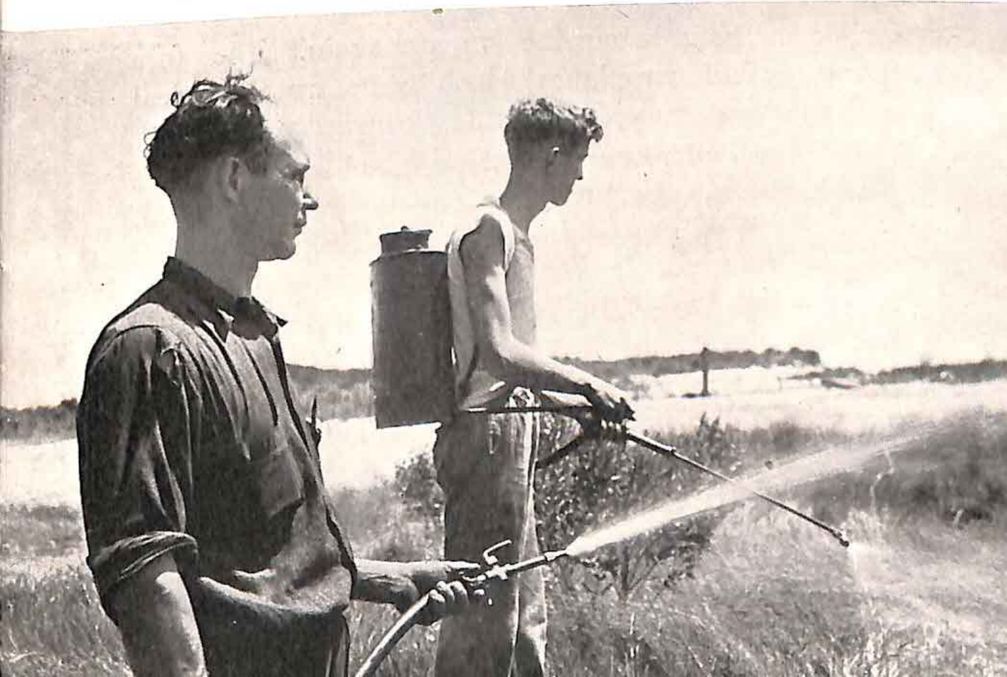
India and Pakistan, in many parts of Africa, in Central America and in many other regions of the world. Malaria-infected mosquitoes were once common in England too and the disease was then known as *ague*. Yellow fever is found in some tropical parts of Africa and with malaria was once so widespread in Central America that these diseases very nearly prevented French engineers from constructing the Panama Canal. When American engineers took over the work almost their first task was to stamp out the mosquitoes.

The control of mosquitoes. Mosquitoes can be brought under control by draining pools and marshes, and by getting rid of, or completely covering, rain-barrels and other storage water in which mosquitoes can develop. Even the water which collects in empty tin cans is suitable for mosquitoes to lay their eggs in, so in tropical countries all such junk must always be buried or crushed in a proper rubbish disposal system.

It is not always convenient or possible to drain

FIGURE 15. These men are spraying poisonous chemicals on places where mosquitoes breed. Large swamps are sometimes sprayed from aeroplanes.

Pix



ponds and marshes. Instead, young mosquitoes can be killed by putting oil on the water or by placing poison chemicals in it. The thin film of oil prevents the larvae from anchoring the opening of their main breathing tube in the water surface and so they are prevented from getting air, and therefore die. Some small fish, such as minnows, can also be relied upon to eat these pests and are specially bred for putting into mosquito-ridden ponds.

If most of the mosquitoes are destroyed, then obviously we are far less likely to get the diseases that they bring us.

Mosquitoes and aeroplanes. A few years ago a very dangerous African mosquito was discovered to be breeding in Brazil. It was of a type well known as a malaria carrier. Fortunately this pest was soon brought under control, but only at great expense. How did the mosquito get across the South Atlantic Ocean ? The answer seems to be that it was brought by an aeroplane flying from Africa to South America.

Even before this happened people knew that insects were likely to be carried across the world in aeroplanes. An insect picked up in Africa at daybreak might be landed in Brazil before the sun rose again. Therefore the cabins of aeroplanes which come from tropical countries are sprayed to kill any stowaway insects.

Rat fleas and plague. Another blood-sucking insect pest is the rat flea. It seems to prefer the blood of rats, but it will also bite humans. These occasional attacks upon people would not be very important if it were not that this flea can carry the bacteria of bubonic plague from rat to rat and from rat to man. Do you know what *bubonic* means ? Look up this word in a dictionary and it may tell you something about the disease.

Bubonic plague is a very dangerous disease which is always to be found in the Far East and in parts of the Near East. It is frequently fatal. Ships carry rats and any of these that are diseased can convey plague to ports of other countries. In 1947 there was a severe outbreak of plague in the island of Malta, in which 80 people were affected and 22 of them died despite modern drugs. The outbreak was brought to an end by a terrific onslaught on rats. In this campaign people all over the island cleared away the dumps where rats might breed while a scientific expert on animal behaviour directed the laying of poisoned bait. When very few rats were left, people found that the plague outbreak was over, and also that another disease from which poor people living in dirty parts of the island regularly suffered had almost disappeared. What does this suggest to you ?

The other disease was a fever which used to be known as jail fever and is now called *typhus.* It is caused by a microscopic form of life which is intermediate between a bacterium and a virus. Typhus is not to be confused with *typhoid* fever which is caused by a bacterium which infects by being swallowed in food or drink.

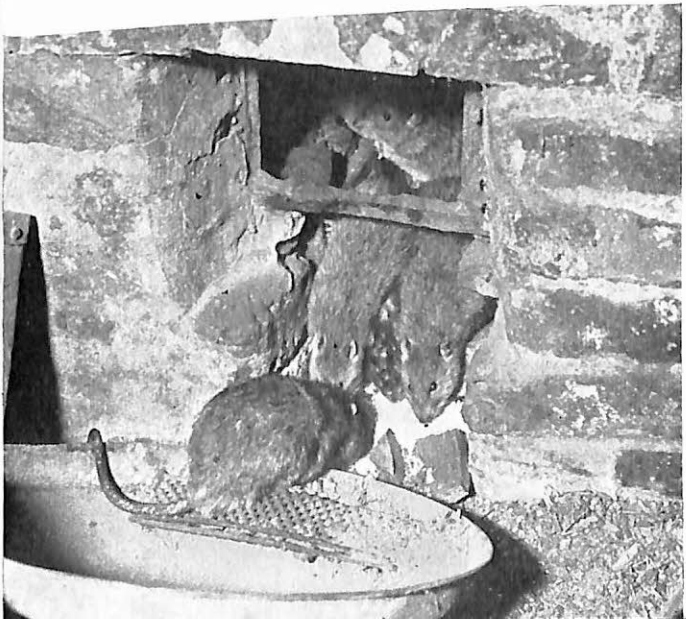


FIGURE 16. These rats are living in the broken wall and eating spilled food. Rats are glad if you leave rubbish about !

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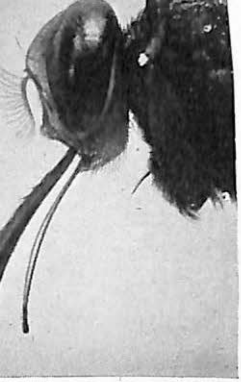

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FIGURE 17. The proboscis or sucking mouth of a tsetse fly is rather like an elephant's trunk, but far more dangerous!

Other flies that bite. Mosquitoes are not the only kind of flies that bite, as most people know from experience. A horse-fly bite, for instance, is usually uncomfortable for a few hours or even for days. But a fly which is a terrible problem in Tanganyika and other parts of Africa is the tsetse fly (pronounced SETSEE) which wipes out cattle with tsetse disease and kills men with the disease known as African sleeping sickness. This fly has made thousands of square miles of land completely uninhabitable to man.

Far less serious, but still very troublesome, are sand flies which infect people with sand-fly fever in countries round the Mediterranean. This fly also carries the parasites which cause the dreadful sores that are common among poor people in the Near East.

House flies carry bacteria. Do not think that an insect must always *bite* man in order to bring him germs. Look at Figure 19 which is a much-enlarged photograph of a house fly. Such a fly does not bite at all. But the female lays its eggs in manure piles, and in rotting animal and vegetable material, all of which is full of germs. It then flies on to our food which it eats by sucking some of it up through a sort of trunk which hangs down in the front of its head. In order to liquefy the food it first pours out through this

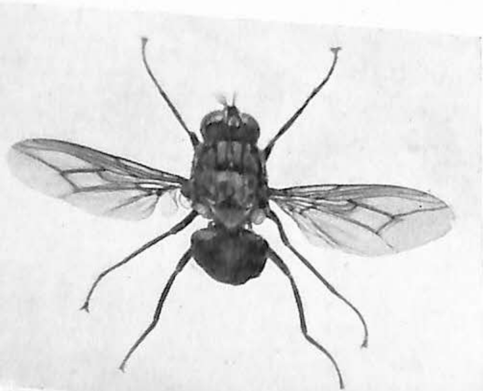

FIGURE 18. This is a tsetse fly which can give people the germs that cause sleeping sickness. This fly is shown 7 times real size.

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FIGURE 19. This is the common house fly. How much larger is the photograph than the fly itself?

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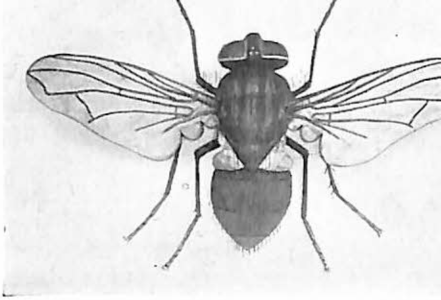

trunk a fluid which dissolves the material it falls upon. Meanwhile from the bristles of its body, laden with dirt and bacteria and viruses, the fly drops infection upon our food. That is why in the warm parts of the United States all windows have wire screens on them all through the summer and all doorways have a second door—a wire screen—which keeps all flies out when the ordinary door is open. It is thought in the United States that flies may help to spread the virus of poliomyelitis, which is often called infantile paralysis. They certainly carry the bacteria that bring about some kinds of diarrhœa and some other diseases.

SOME THINGS YOU MAY CARE TO DO

1. Catch as many flies as you can in or near the house. Examine them very carefully under a lens. See if they have all the same pattern of veins in their wings. If not, then they are of different kinds. There is only one kind of fly found in houses in the United Kingdom which is the true " house fly."

2. Catch and kill in an insect-killing bottle, some " blue bottles " (" blow flies ") and " green bottles." Examine them carefully under a lens and in the case of the blue bottle notice the hairs that can so easily carry dirt to our food. Read up the life history of these flies in a book on insects. How can these flies affect health?

3. Prepare a talk to your class on rats and the best ways of getting rid of them.

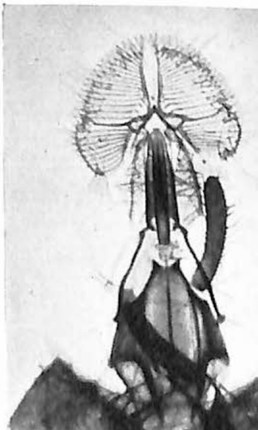

FIGURE 20. The proboscis of a house fly.

Harold Bastin

Problem B: HOW CAN WE GUARD AGAINST THE ENEMIES OF HEALTH?

Until about one hundred years ago, when Pasteur and others proved that the cause of many diseases is the presence of harmful bacteria in the body, there was not a very great deal that doctors could do to guard health and to cure illnesses. There was, however, one thing that they could always do, a thing which had been pointed out by an ancient Greek doctor who lived 400 years before Christ. Doctors, said this great physician called Hippocrates, must always remember that their most important task is to help Nature to fight the disease. So the patient must not be allowed to waste energy or have the wrong diet and so on. Helping Nature to fight back against disease is still one of the doctor's most important tasks.

Now that we know the causes of many diseases—though not of all diseases—we can do a good deal to guard against them. Also, by the use of X-rays, which were discovered only 60 years ago, we can now often find out the internal causes of pain. For instance we can readily find whether pain in a limb is due to a strain or to a cracked bone. (See Figure 48.) If there is a bad fracture the broken bone can be *felt*: but an X-ray helps in making sure that broken ends are put together exactly. Chest X-rays also enable us to detect the very early stages of tuberculosis of the lung, which can be cured when found early enough.

In countries where modern science is well developed, most people may expect, except for war and accidents, to reach the age of sixty, and many live far beyond that age. If we all use the knowledge that scientists have given us about the enemies of health we can help greatly to reduce the amount of bodily suffering in the world.

Question 1. **How do Disease Agents get into the Body?**

We have already found that some insects can put disease agents into our blood when they bite us. Other insects infect with bacteria or viruses the food that we eat. But today diseases caused in these ways are not very widespread in the cooler parts of the earth. Yet there is plenty of disease there and illnesses such as measles, mumps, whooping cough, colds and influenza are common enough and more serious ones such as tuberculosis of the lung are by no means stamped out though much reduced in dangerousness. In what ways do we " catch " these diseases ?

Roughly speaking we can say that the bacteria and viruses are *inhaled* into our lungs with our breath. We " catch " the diseases from the breath of other people suffering from the disease or about to suffer from the disease. Illnesses which can be " caught " in this way are called *infectious* illnesses. When people cough, their breath is carried further than usual and it has been proved that when a tuberculous person coughs the bacteria can be sent into the air for more than thirty feet.

In some diseases, such as mumps, people are most infectious to others just *before* the disease makes itself apparent and in others the most infectious stage is the very beginning when there does not appear to be much wrong with the person. That is why it is so difficult to stamp out epidemics of infectious disease.

Not everyone who is exposed to such an infection as influenza will develop the disease : this depends upon the resistance, the state of health and the state of fatigue of the person, and so on. Generally, too,

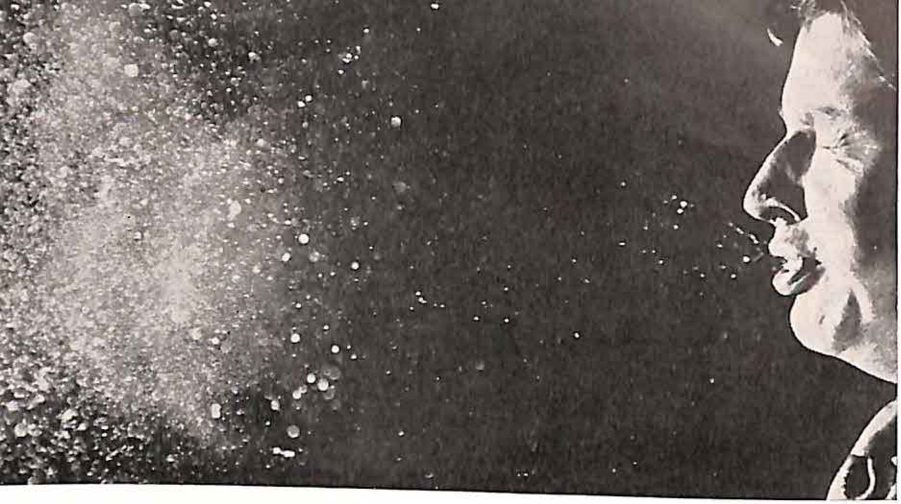

FIGURE 21. This is a careless sneezer! Thousands of germ-laden droplets are shot far into the air.

we have to inhale a good deal of the breath of an infected person to get the disease. Nurses can wear a disinfectant mask to protect themselves.

An interesting experiment on infection was carried out years ago with ferrets infected with dog distemper. When the hutches of ferrets were immediately on top of one another out of doors, if one ferret was infected the one immediately above or immediately below generally caught the disease. But ferrets in other hutches several yards away did *not* catch the disease. What does the word "isolation" mean? There is no doubt that a great deal of illness would be avoided if people would isolate themselves in the early stages of colds and influenza and if they would take great care always to sneeze into a handkerchief.

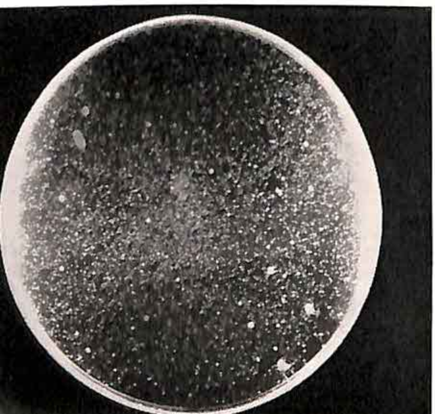

FIGURE 22. This is an enlargement of the droplets which fell on a plate held 3 feet away from the man sneezing in Figure 21. 19,000 colonies of living germs were counted on this plate!

There are some diseases, however, which are "caught" in quite a different way, namely by *contact* with the infected person. Examples are different forms of skin disease and such things as boils. Generally there must be more than just contact; the uninfected person must have some cut or scratch on his skin into which the bacteria can get. Do you remember how we describe diseases which are caught in this way?

It is not only from other people that disease may enter cracks in our skin. Bacteria from road dust or from soil can enter just as easily. The bacteria of the disease lockjaw can be found in well-manured soil. (The right-hand picture in Figure 24 shows you the bacteria that cause lockjaw.) So you can see why it is important to use soap and water to keep your hands clean, and why it is well to treat a cut or deep scratch with an antiseptic such as iodine. Many boys wisely carry a small iodine pencil in their pocket to look after their friends and themselves, especially when on a camping holiday.

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SOME THINGS YOU MAY CARE TO DO

1. Here are some names of famous doctors of the past. See if you can find out when and where they lived and what they are famous for—Galen, Vesalius, Harvey, Paracelsus, Avicenna.

Here are some more famous names. Perhaps you and your friends can each take one of these names and find out what we owe to the person who bore that name: Florence Nightingale, Sir James Hope Simpson, Dr. Walter Reed, Dr. Jesse W. Lazear, Sir Ronald Ross, Sir Frederick Gowland Hopkins.

2. Start a collection of X-ray photographs taken from popular scientific and other magazines.

Question 2. **What Special Defences do our Bodies have ?**

What you have just learned about ways in which bacteria and viruses enter the body may seem rather disturbing. Even if many of them are kept out, some are almost sure to get in. This does not mean that the battle is lost, however, for the body has other ways of fighting off invasion. Bacteria and viruses may enter now and then but most of them do not succeed in causing active diseases. To do so they must first multiply, in most cases, and become more numerous. But special defences of the body may prevent them from increasing.

Some of the more important defences are found in the blood, so we shall now give closer attention to this fluid. If you are able to look at a microscope slide bearing human blood you will see something like what is shown in Figure 23. The basic fluid is straw-coloured and is called the *plasma*. Carried by the plasma are the red cells which we call *red corpuscles*. This word *corpuscle* merely means "a little body." The plasma also carries white cells called *white corpuscles* which are rather larger than the red corpuscles, are less numerous, and differ from the red ones in lots of ways.

The red corpuscles are discs, thicker at the edge than in the centre. They contain a substance which absorbs oxygen and makes them look red, and their main work is to convey oxygen to the cells of the body and take away the carbon dioxide which the cells have produced.

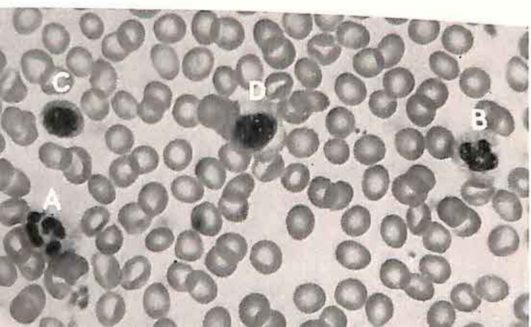
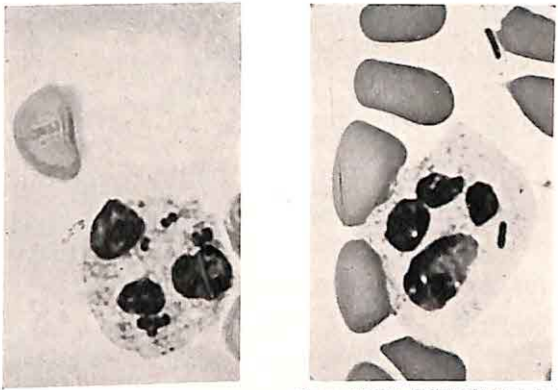


FIGURE 23. This picture shows many red blood corpuscles and four white blood corpuscles. A and B are of the kind that destroy bacteria, but C and D perform different duties in the blood.

By courtesy of Dept. of Medical Photography, Westminster Hospital

Can you remember where it is that the blood gets rid of its carbon dioxide and takes up a new supply of oxygen ?



From Wright, "Introduction to Pathology"

FIGURE 24. These photographs show white corpuscles 1,200 times their real size. In each photograph the white corpuscle is destroying enemy bacteria.

A few of the white corpuscles have a rounded outline, like the red ones, but these white corpuscles are really more spherical than disc-shaped. The rest of the white corpuscles generally have not a fixed shape and their edges are irregular. They also contain a denser spot which is called the *nucleus* (this means " kernel ") which is not present in red blood corpuscles. One of the tasks of these irregular white corpuscles is to destroy bacteria, as shown in Figure 24, or to make them harmless. They are one of the important bases for what is called *immunity* to disease, that is, the partial or complete power to resist the invasion of certain kinds of bacteria or virus.

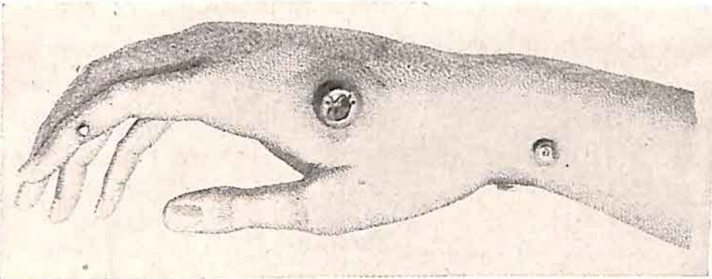
Unfortunately, being immune to one disease, such as mumps, does not make a person immune to something else, such as scarlet fever or measles. Many people, however, have a number of partial or complete defences of this nature. Such immunities are sometimes present at the time of birth. Others are acquired or developed by having the disease in question. But this is not a pleasant way to become protected. A much better method is to let a doctor inoculate you and so make you immune to such a disease as diphtheria.

Look at the figures below which show the effect of many years of nation-wide campaign for immunization of children under fifteen against diphtheria. The campaign began in 1940 and was intensified in 1941. The figures apply to England and Wales.

	All cases of diphtheria at any age	Number of deaths	Estimated percentage of children immunized
1941 . . .	50,797	2,641	30
←	Campaign intensified		→
1942 . . .	41,404	1,827	50
1943 . . .	34,662	1,371	55
1944 . . .	23,199	934	55
1945 . . .	18,596	722	61
1946 . . .	11,986	472	61
1947 . . .	5,609	244	61
1948 . . .	3,575	156	63
1949 . . .	1,881	84	66
1950 . . .	962	49	67
1951 . . .	664	33	68
1952 . . .	376	32	70
1953 . . .	266	23	70
1954 . . .	182	9	70

Supposing that the number of deaths from diphtheria had remained in 1954 the same as in 1941, how many extra deaths would there have been? Most of these would have been of children, because this disease is particularly dangerous to children under six.

The earliest method of gaining immunity against a disease without having to have the disease itself was by *vaccination*—against the terrible disease smallpox.



From Singer, "Short History of Medicine" (O.U.P.)

FIGURE 25. This dairy-maid has cowpox on her hand. Jenner noticed that this disease gave her immunity from smallpox.

This method really consists in making a person immune against a much milder disease called cowpox, and it was invented by a Dr. Edward Jenner as long ago as 1796. He, and others, had noticed that dairymaids who caught cowpox from their cows were always immune from smallpox. And the word *vaccination* really comes from the Latin word *vacca* which means a "cow."

Some of the immunities which we develop are likely to prove quite strong and lasting. Others are weaker, and merely prevent a bad case of a given disease. Some last only for a certain length of time, after which the protection is gone unless it can be renewed in some way.

Other defences. Bacteria that you swallow with food and drink may also be destroyed by the body. Some of the cells of the stomach lining, for instance, produce an acid. Normally, there is never very much of this acid in the stomach. Nevertheless, there is often enough to kill many bacteria that come in with our foods.

These defences which we have mentioned, and others that you will learn about later, tend to make the body secure against many microscopic enemies. Even when invaders gain entrance they do not necessarily succeed in making serious trouble. If they do cause an active case of disease, their period of success may be short-lived if the patient gets quick and proper attention.

SOME THINGS YOU MAY CARE TO DO

1. Examine under a microscope some prepared slides of blood, not only of human blood but of that of other animals. What is the difference in appearance of red blood corpuscles in frogs and in human beings ?

If no prepared slides of blood are available, perhaps your teacher will let you look at some of his. To do this he will twist a piece of thin string tightly round the top joint of his left forefinger, then bend it and clean it with alcohol. If he then pricks the swollen part of the finger with a sterilized needle, he can then squeeze out a few drops of blood. These should be put on microscope slides with some drops of " normal " salt solution, i.e. water containing half a gram of salt per 100 cubic centimetres. This is about the same strength of salt as in human blood plasma and this stops the blood from clotting on the slide.

2. Read up more about Dr. Edward Jenner and the beginning of vaccination. Can you find out how, before Jenner, Lady Mary Wortley Montagu had tried to get people thinking about vaccination ?

3. See if you can find out anything about the different " blood groups " to which people belong. If so prepare to give a talk to your class about it and explain how the existence of " blood groups " affects the work of doctors in blood transfusion.

4. Find out the name of the Medical Officer of Health of your town or district. What are his duties ?

Question 3. **How can we guard Personal Health ?**

Having studied some of the causes of illness, let us see what general care the body must have, whether or not it is threatened by disease. As you may often have heard, a strong healthy body is often better prepared to withstand attacks by bacteria and viruses than is a weak one.

Also you should remember that not all diseases are caused by infection or contagion. Quite a lot are produced by unwise habits, such as overeating, excessive smoking, immoderate use of alcoholic drinks, insufficient time for sleep, and so on.

There is also one source of poor health that some young people forget, and that is bad teeth. Harm that is caused by neglect of teeth when one is young can never be made up later. And teeth which have decay in them often set up other troubles as well. Teeth require a certain amount of care if they are to be defended against bacteria and if they are to remain in a healthy state. Let us see why this is the case.

Figure 26 shows a diagram of a human tooth. You can also look at models, pictures, and charts that are similar. The root or roots of a tooth lie in a bony socket, and only part of the tooth is exposed. The outer covering of this exposed portion is made up of dense, hard *enamel*. Then comes a much thicker layer

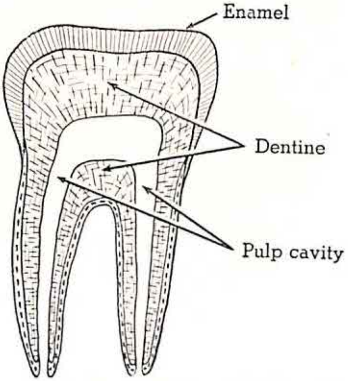


FIGURE 26. Diagram of a human tooth.

of the softer *dentine*. In the interior of the tooth is a *pulp cavity*, which contains nerve endings and blood vessels.

Can you see why a tooth would be sensitive to something very hot or cold?

What might happen if the enamel became cracked or broken?

Care of the teeth. The teeth should be brushed at regular intervals. If they are not kept clean, particles of food and other materials collect in the spaces between them. So do various bacteria, which may not be very dangerous to general health, but may hasten the decay of teeth. A regular inspection by a dentist (about every six months) is very important, because small breaks in the enamel will then be detected before cavities become large. Once there is such a break in the outer layer, it is only a question of time until the softer dentine becomes badly affected and the tooth begins to ache. Bacteria that live in and about diseased teeth can be carried to other parts of the body where they are likely to cause even more serious trouble.

Even if there is never any sign of decay it is important for young people to continue the six-monthly visits to the dentist until the complete set of teeth is formed, so as to make certain that the teeth are not too crowded and that all are in correct position. The last teeth to be formed are the four "wisdom teeth" at the very back of the jaw. These do not usually come through until people are sixteen years of age or older. Can you see why they are called "wisdom teeth"? Some people, however, never develop wisdom teeth.

Eyes and ears. Other parts of the body that require special care are the eyes and the ears. Eyes can be injured by reading or doing work in light that is either too dim or too glaring. When we read with the aid of a lamp, the light should be allowed to pass over one shoulder and fall upon the printed page. Many people have eye defects of one kind or another. This is why it is important to have the eyes examined and see whether anything is wrong. Wearing the right kind of eyeglasses will often correct defects of sight.

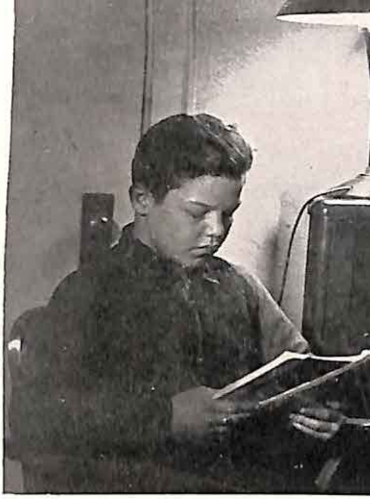


FIGURE 27. The right way to use a reading lamp.

The ears are also rather delicate structures that may be badly damaged by thoughtless actions. As someone has said, no person but the doctor should try

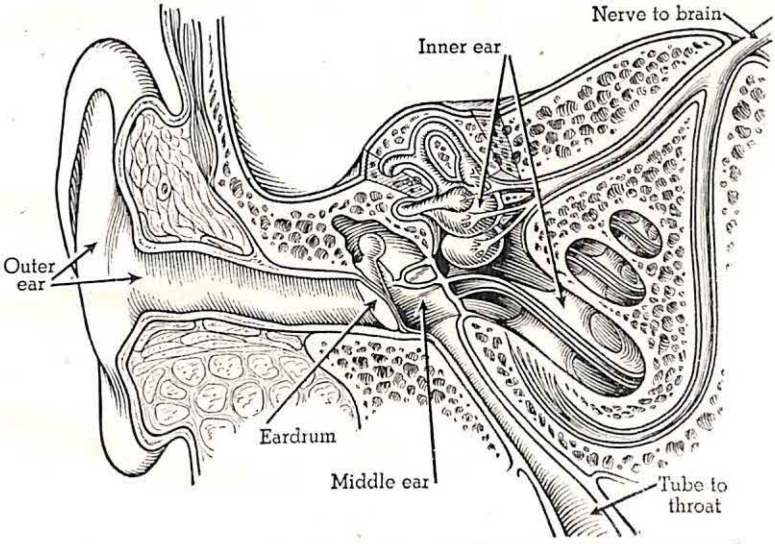


FIGURE 28. Note the location of the eardrum at the entrance of the middle ear.

to put anything smaller than an elbow in the human ear. Only a short distance within the outer cavity of an ear is the eardrum, which can easily be injured or destroyed. If you swim and dive it is wise to protect the ears from getting water in them all the time. And in countries which have an extreme climate, with very cold winters, people regularly keep their ears covered when out of doors. In the northern parts of the United States and Canada children wear furry ear pads during the winter.

The ears are so delicate that even blowing the nose may injure them if it is done in an unreasonable manner. When the nose is held too tightly, air and mucus containing bacteria may be forced up a pair of tubes that connect with the ear cavities.

Other health rules. You have already learned that in order to keep well it is important to eat the right foods and to get enough of the right vitamins. Most people do not eat enough raw fruit and in the British Isles people generally do not eat as much raw vegetable salad as they ought. Have you heard of the famous "Oslo breakfast" which is given to school children in Norway? It generally consists of raw vegetable salad, cheese, milk, fruit and rye bread.

Sleep is another matter which is often neglected People vary in the amount of sleep that they need, but most of them require eight or nine hours a day if they are to keep well. Have you heard the old saying that every hour of sleep before midnight is worth two hours after midnight? And can you complete the proverb "Early to bed and early to rise . . ."?

Keeping clean is also very important, for any dirt which collects upon the skin is almost certain to contain bacteria. Also, unless the skin is everywhere kept clean the pores cannot work properly in allowing moisture and salts to pass out of the body. So could you now give scientific reasons why the old proverb "Cleanliness is next to godliness" is such a sound one?

SOME THINGS YOU MAY CARE TO DO

1. If you can obtain a tooth from the skull of a horse, dog, or any other large animal, saw it in two with a hack-saw. Observe the enamel and dentine layers and the pulp cavity.

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2. Study a model or chart of the human ear. Learn how vibrations pass from the eardrum to the inner ear. Find out how the ears are connected with the throat cavity.

3. Examine your own skin with the aid of a hand lens or reading glass. Note the many pores. Rub a little chalk dust over the skin and observe by means of a lens how it collects in the pores and the openings through which hairs emerge.

4. Obtain or make a reading chart to test eyesight. Compare several persons as to their ability to see the smaller letters at a given distance. You may also find differences between the two eyes of a given person. Discuss how shortsight or longsight would affect the abilities of (*a*) a pilot, (*b*) the driver of a motor-car.

5. Get all your class to tell you at what time they usually go to bed on the different nights of the week. See if there is any relation between having enough sleep and keeping well and doing well in school work.

6. Try to find out the effect of *fluorides* in drinking water on teeth and whether any traces of any fluoride are present in your local supply.

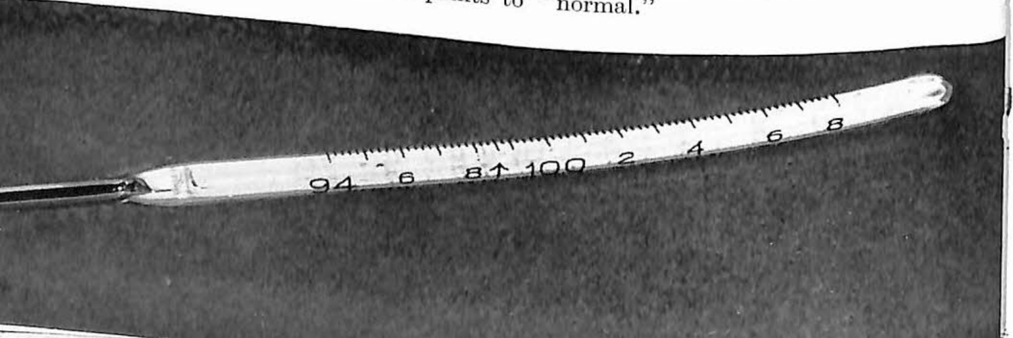
Question 4. **How should we deal with Illness?**

You have already seen that there are various ways in which we can protect ourselves against infections. Even when precautions are taken, however, bacteria and other agents of disease do get into our bodies. Most people, for example, have a good many common colds in the course of a lifetime. Many of these are not very serious, but they make one feel uncomfortable, and at best interfere with work and play. In the case of colds and some other sicknesses, it is often necessary to decide whether or not a person is seriously ill when he does not feel well.

Figure 29 shows a little instrument that everyone should be able to use. It is a special type of thermometer for measuring the temperature of the body. Perhaps you can examine one and learn how to read it. Note, however, that it should never be passed from mouth to mouth, because in that way infections are spread.

Remember that normal temperature is about 98·4° F. Hold the thermometer in your hand, and turn it around slowly until you can see the thin column of mercury. It should stand a few degrees below normal. If it does not, hold the thermometer by the top, and act as if you were striking downward in the air. This will usually shake the column of mercury down. Be careful not to let it slip out of your hand. Now place

FIGURE 29. A thermometer used for taking human temperature. The arrow points to "normal."



the bulb of the thermometer in the mouth, below the tongue, and leave it there for about three minutes. Keep the mouth closed meanwhile, and be careful not to break the bulb of the instrument. Then remove the thermometer and read it. If it is above normal, you have a fever.

What might happen if the temperature of the room was 100° F. or more?

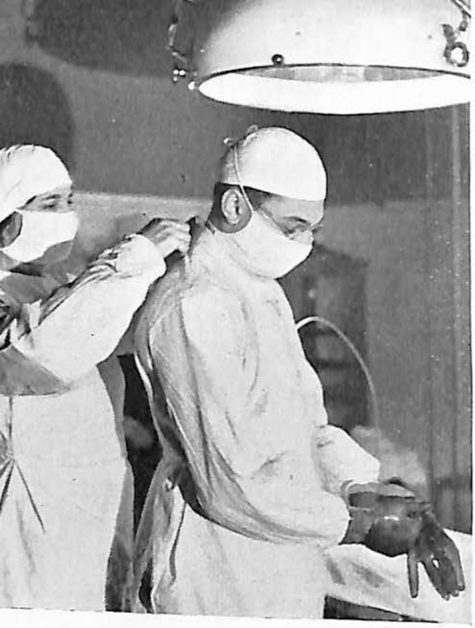
How would you clean the thermometer before putting it away again?

FEVERS AND COLDS

Fevers. Fever is a warning sign in the case of many diseases. A mild fever (of less than a degree above normal) may not indicate anything serious unless it continues from day to day. When the body temperature goes up more than a degree, however, the person is probably ill, and may need the advice of a doctor. Meanwhile, it should not be forgotten that fevers do not accompany *all* illnesses, and particularly not the early stages. Other signs, such as an upset stomach, may be the first warning that something is amiss.

Common colds. Let us return now to the matter of common colds. Despite years of careful study, doctors are still not certain exactly what causes them. The evidence does tend to show that they are due to the presence of one or more *viruses* as well as of bacteria.

When you get a common cold, other bacteria that have been in your nose and throat sometimes become active. Such bacteria may, for instance, be located in your tonsils. So then you are not suffering from the common cold alone, but also from the presence of these other invaders. There is also the possibility that there



Lambert

FIGURE 30. Masks like these are used to avoid spreading infection.

actually are different types of cold viruses. Usually, colds are not very dangerous unless they are accompanied by high fevers. The neglected cold, however, may be followed by a more serious ailment, such as pneumonia.

Does your doctor tell you to stay in bed when you have a cold ? There are at least two reasons why this is a good idea. Colds usually clear up more rapidly if the victim is resting. Then, too, if the person with the cold is in bed, he is not walking around and giving the disease to a host of other people.

SOME THINGS YOU MAY CARE TO DO

1. Make a survey of the class to find the average number of colds per person per year and at what times of the year they usually occur. Find out what precautions they take to avoid colds and to keep from passing them on to other people.

2. Try to obtain copies of recent annual reports of the Medical Officer for your town or county. Prepare a report for your class on the health of your area.

3. A number of serious diseases are known as " fevers " of different kinds. Use an encyclopedia and prepare a talk to your class on this subject.

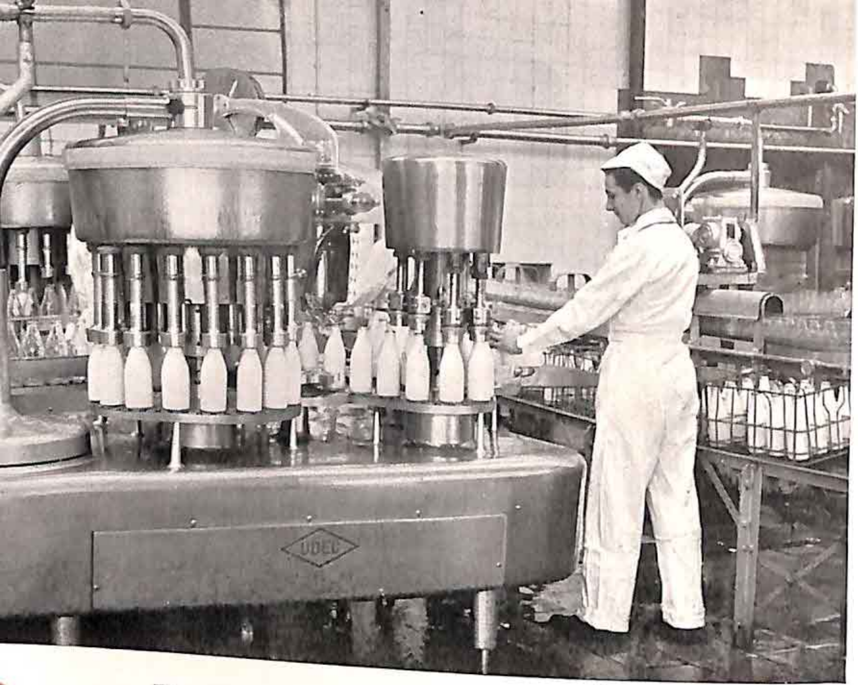
Question 5. What can the Community do to protect Health ?

We have previously considered ways in which individuals may be protected. In a sense, of course, any person who is ill or has had an accident is not merely an individual or a family problem, but also a community problem. A person who is ill may be a source of infection to hundreds of others, while a person who is fit and well can contribute to the work, the happiness and the well-being of all. That is one of the reasons why in the United Kingdom, and in a number of other countries too, there is a National Health Service.

But the existence of organized community help does not lessen the responsibility of individuals to take sensible precautions to keep themselves healthy: indeed it increases their responsibility, for no one should be dependent upon the work of others any more than he can possibly help. Similarly the community must do all it can by suitable laws and regulations to make sure that no unnecessary source of infection is permitted.

For instance in most up-to-date countries great care is taken to ensure that the milk supply is free from dangerous bacteria. Unless it has been taken under very clean conditions from cows which are regularly tested to prove that they are free from tuberculosis, milk generally has to be *pasteurized*. Can you guess the origin of this word and what it means ?

Have you ever visited a plant in which milk is pasteurized ? If not, perhaps your teacher can arrange a class visit. Such an experience would probably teach you many useful things. Milk is one of the best foods,



Courtesy, United Dairies Ltd.

FIGURE 31. A milk-bottling plant. What precautions are being taken here ?

especially for young people. It can also be a very dangerous thing to put into the body if it contains harmful bacteria. If you have ever seen a cow milked, whether by hand or by machine, you will have seen how easy it could be for a little dirt to get into the milk. And dirt usually contains bacteria and these multiply rapidly in milk. So you can see why pasteurization is usually necessary. In pasteurization milk passes through a machine where, for a few seconds, the temperature of the milk is quickly raised high enough to kill dangerous bacteria and then just as quickly lowered. The whole process takes less than half a minute with modern machinery, and by this means the flavour and the food value of the milk are hardly changed at all.

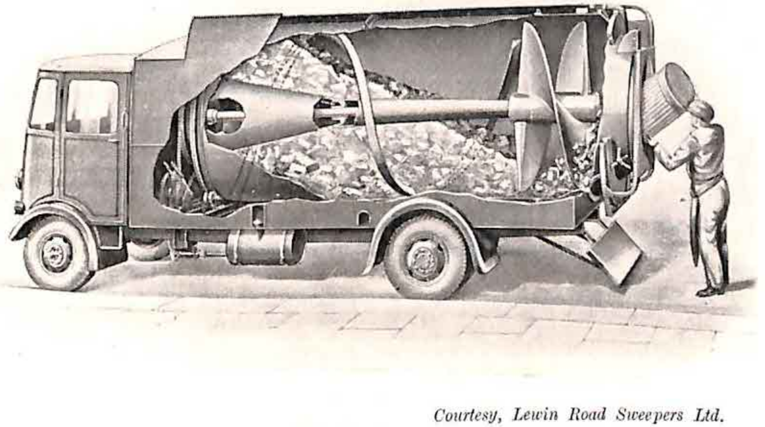
Can you see why a supply of pure milk is really a community problem ?

In almost any settled community the disposal of household waste and rubbish is an important matter. In some places in the Near East and in the Far East people still behave as they used to in England in the Middle Ages—they throw their dirty water and rubbish out on the road. But such examples decrease year by year as people learn what health troubles they bring upon themselves in this way.

Look at Figure 32. This shows you a modern vehicle for collecting household refuse. In what way is it better than the old open " dust carts " into which the men used to empty the dustbins ?

In some towns the kitchen waste is collected separately and, after being sterilized to kill the bacteria, is used to feed pigs. Do you know of any town where this is done ? There are at least two reasons why this is a sound idea : can you think of them ?

Some towns " dump " household refuse on low-lying ground. *Can you suggest how this might have disadvantages ?*



Courtesy, Lewin Road Sweepers Ltd.

FIGURE 32. Can you see how the rubbish is packed in this modern " dust cart " ?

DRAINS

Everybody knows how important good drains are for community health. But there are many communities in the world where proper drains do not exist and where people are too poor to pay for them to be made.

Can you think of any parts of the world where this is true ?

Do you know where the sewage works of your own community are situated and whether any use is made of the sewage sludge ? In some places the sewage is allowed to give off a gas which is burned to drive machinery, and one town near London makes its sewage into a very convenient powdery fertilizer which can be sent all over the country. Perhaps a class visit can be made to your local sewage disposal works. It is important that the water from sewage works that makes its way to rivers shall be reasonably free from dangerous germs and from harmful chemicals. Why ?

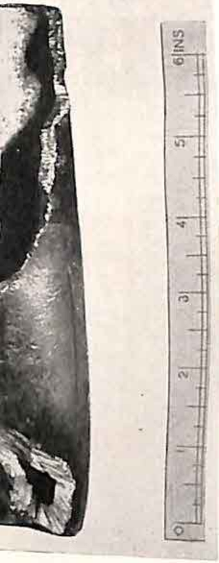
WATER

The water supply of a town is the most important of all community services. Can you see why ? Often it was the water supply which originally decided the spots at which many towns and villages grew up : without springs or streams people could not live. Where does the water of your own town or village come from ? Does it come from springs or from a river ? Is it filtered and does it have to be treated with chlorine before it is pumped into the pipes ? What is the purpose of treating water with chlorine ? If it is not too far away, a visit to the waterworks of your own water supply is very much worth while.

Keystone, London

FIGURE 33. Why does water in a swimming bath taste of chlorine ?

Pure food and drugs. Most up-to-date countries have special laws which are intended to make sure that people who sell food sell only good food and also that all drugs sold are pure. Unfortunately many of these laws are not strict enough and unscrupulous people sometimes manufacture foods out of materials not all of which are nutritious and some of which, perhaps, are mere filling or perhaps even harmful. Probably the country which has the best laws on food is the United States, where the laws also require that the people who handle foods are free from disease and have to be periodically checked by doctors. Most other countries need more laws to ensure that people are not persuaded to buy foods which are not what they seem to be. *Can you think of any foods or dishes which might contain other ingredients than the buyer hopes to find ?*



Crown Copyright. By permission of the Controller of H.M.S.O.

FIGURE 34. This piece of lead pipe was gnawed away by one rat in 48 hours! Why did it do it?

News Chronicle

FIGURE 35. There are nearly 4,000 miles of sewers under London. These men are putting poison bait down one of the 42,000 manholes during a great campaign to clear rats out of the sewers.

Rodents. Food may become polluted not only by bacteria brought by rats or mice but also by the excrement of these creatures. Mice are much the less harmful of these two rodents and most people know how to deal with them in their houses, so this is scarcely a community problem.

But rats are a different proposition and in Britain most communities have a special rodent control officer and everyone pays a little in the " rates " for keeping these pests under control.

Many rats live in sewers and make their way into warehouses and gnaw into sacks of flour or into cheeses or into boxes of butter: indeed there is hardly anything into which they cannot gnaw. " Rodent " means " a gnawer." Look at Figure 34 which shows a piece of lead pipe gnawed by a rat. Rats *must* gnaw hard things because their front teeth continue to grow and would overlap if they were not kept worn down by gnawing. But as we already know, they bring fleas as well as dirt, and civilized man must keep rats out of his community as much as he can. The newest poisons now available are so deceptive to the rat that he is going to have a very hard time in his struggle for existence.

SOME THINGS YOU MAY CARE TO DO

1. Find out from your milkman what kinds of milk he sells and what is the difference between them. Have they all been pasteurized ?

2. In some regions goats' milk, rather than cows' milk, is commonly used. See what you can find out about keeping goats and about the quality and uses of goats' milk.

3. Try to find out what happens in your town to the refuse which is collected. Is it put to any useful purpose ?

4. Produce a large diagram showing where your water supply comes from and where it is stored and how it is pumped to your house.

5. Read up about whole meal flour and prepare a talk to show why it is better for health than whitened flour.

6. There are two main types of rat : the one called the black rat and a larger one called the brown rat. There are very interesting differences in their habits. See if, by using an up-to-date encyclopædia, you can write the story of the rat.

7. If you like exciting stories about rats, learn to recite Robert Browning's poem on " The Pied Piper of Hamelin " and Robert Southey's poem on " Bishop Hatto."

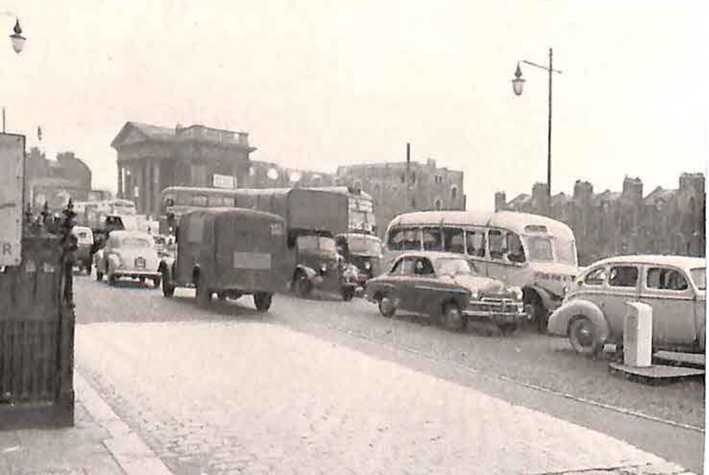
Problem C: HOW CAN WE GUARD AGAINST ACCIDENTS?

Accidental injuries are also a common cause of bad health. "Accidents will happen" has come to be a common saying. True enough, there are a lot of them, ranging from the many that cause only minor cuts, scratches, and bruises to those that result in death. No doubt you have sprained an ankle, been burned, cut, or scratched on more than one occasion. Such things probably will happen to you again and again. It is a good idea, however, to guard against them as much as you can. At least, there is no sense in meeting with an accident purely as the result of carelessness.

Figure 36 shows the sort of spot where serious accidents tend to happen. In important built-up areas it is not always possible to put a central island where many roads meet, for to widen the cross-roads would mean taking down great buildings. In such places, where five or six roads converge, accidents can only be avoided if all drivers of vehicles watch the traffic lights, observe carefully the rules of the road, and show consideration to other drivers.

FIGURE 36. A black spot for traffic accidents. The notice board says: Use the Subway—Quicker and Safer!

Lesame



Also, pedestrians must " play the game " by waiting until the traffic has been halted before crossing the road at such a congested spot. But it is one thing to know what to do and it is another thing to do it. A few years ago English newspapers told of a schoolboy who wrote in an essay " No one should rush across the road in front of moving traffic." Half an hour later he rushed out of school and did just that thing and was killed.

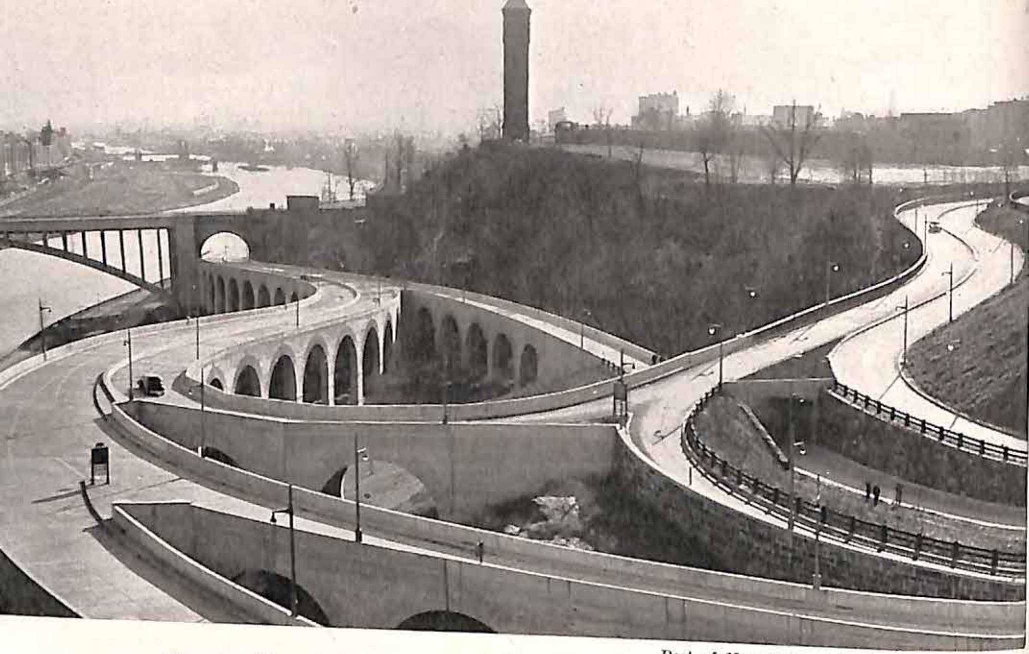
Problem C : How can we guard against Accidents ?

Question I. **How can Accidents be Avoided ?**

We have just considered the special difficulties of a busy cross-roads. Such places are particularly dangerous for pedestrians. It is, however, the open road which is often the most dangerous for the motorist, because that is where he is likely to indulge in high speed.

The real trouble with high speed is that one cannot stop quickly enough. On a piece of scrap paper work out how many feet per second are travelled by a car going at 60 miles per hour. When you have done this sum you can consider what happens if a man driving at this speed takes two seconds before applying the brakes after he has seen an object in the road in front of him. He will have travelled over 150 feet (how many exactly ?) before his brakes begin to act and they require a second or two to bring the car to a standstill. Even then he and his front passengers may be thrown violently against the windscreen and injured. Stopping the car is only half the battle, especially if the driver has not signalled to the car behind him that he is going to stop suddenly.

So the greatest enemy to road safety is the speed of vehicles : great speed does not give time to cope with a dangerous curve, or a swerving cyclist, or a dog or

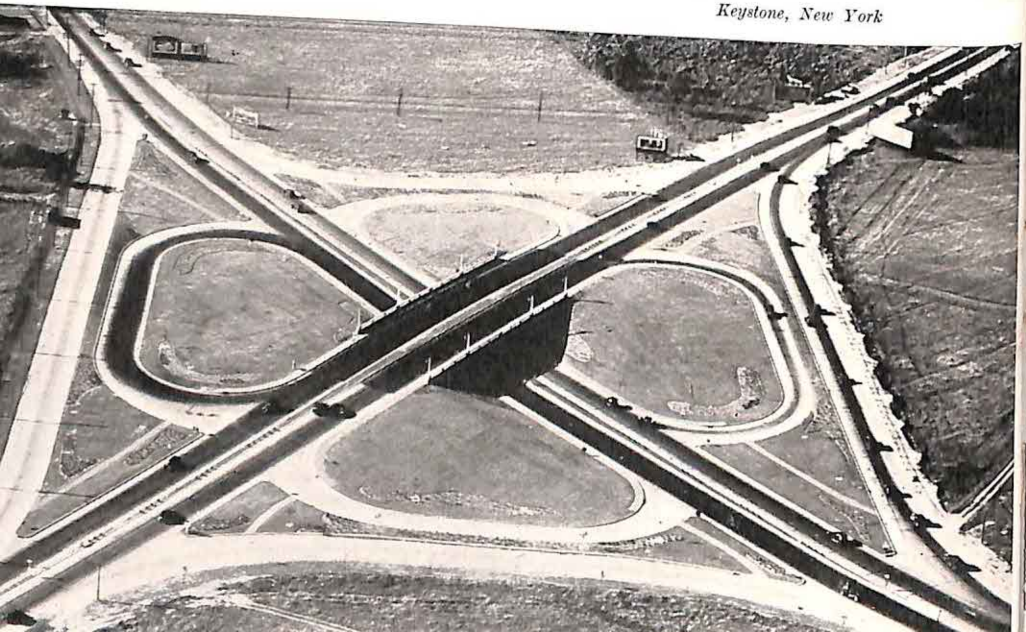


Port of New York Authority

FIGURE 37. This is part of the great turnpike road which runs out of New York in the direction of Washington. How does the lay-out of the road help to avoid accidents ?

FIGURE 38. This is called a "clover leaf crossing." Work out why no car ever crosses another. (Remember that in America cars keep to the right of the road.)

Keystone, New York



child that has run into the road, or another car that is on its wrong side. " I love the early morning—the roads are so empty " is an example of " Famous last words " of motor-car drivers.

Testing of drivers. Even with the best of roads and the best of intentions accidents can easily happen if people in charge of cars do not properly know how to drive. That is why most countries have driving tests which people have to pass before they are allowed a licence. Even this precaution, however, fails if properly licensed drivers, in growing older, continue to drive when their sight is failing, or their joints are getting stiff and their movements too slow. Far worse, however, is the case of the driver whose actions have been slowed down by even a small quantity of alcoholic drink—for, as we have seen, to be one second slow in putting on the brake when a car is travelling 60 miles an hour means that one has travelled nearly 30 yards during that second. And one of the important facts about alcoholic drink is that it does always bring about at least a slight slowing of action.

Can you now see why no one should take alcoholic drink when he is about to drive a car?

Cyclists and road accidents. It is an unfortunate fact that a very large proportion of road accidents involve pedal cyclists, and of these nearly one-fifth are children under fifteen years of age.

Often the accident is not their fault, but in many cases carelessness or " playing about " is the cause. Two or three broken bones is a heavy price to pay for practising riding a circle on an ordinary, not-very-busy, road, but that is the sort of penalty that young people sometimes pay.

A still more common fault is cycling at night without a lighted back lamp. Everyone who owns a bicycle should make it a matter of pride that his cycle is always in good order, wheels properly adjusted, axles oiled, brakes in excellent state, tyres in good condition and so on. Such precautions not only help to reduce accidents but they avoid a lot of annoyances and failures to carry out one's plans.

A careful study of records of road accidents has naturally shown that there are certain times and ages when the risk is much greater than at other times. For instance if the risk run by a twelve-year-old boy walking to school on a June schoolday is given the figure 20, then the average risk run by a fifteen to sixteen-year-old boy cycling in England on a Sunday in June is over 750, and this is the highest known accident risk in the country. Overtaking or taking a right turn account for a quarter of these cycle accidents. Some people think that every cyclist ought to be compelled to have a driving mirror so as to be able to see what is behind him without turning his body and a direction-indicator that he can use without taking a hand off the handlebars, as this sometimes causes swerves.

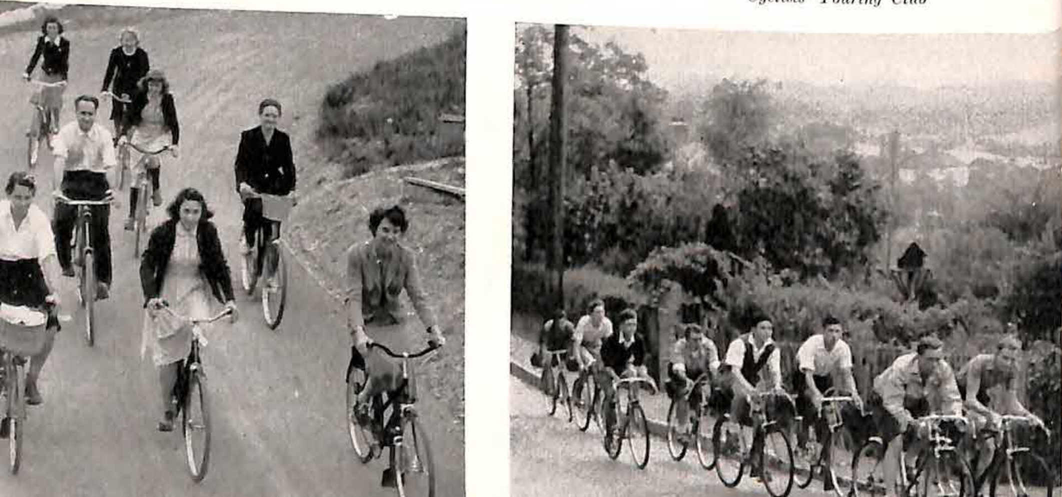


FIGURE 39. The wrong and the right way to cycle together.

Fox Photos Ltd. *Cyclists' Touring Club*

Look at the table of casualties in road accidents in Great Britain in 1953. Roughly what percentage or fraction of the people killed were under fifteen ? And roughly what percentages of the seriously injured and the slightly injured were under fifteen ?

	Died		Injured				Deaths and injuries	
			Seriously		Slightly			
	Total	of which children (under 15)	Total	of which children	Total	of which children	Total	of which children
1953								
Jan.	389	48	3,686	498	10,750	1,691	14,825	2,237
Feb.	345	54	3,380	558	9,361	1,794	13,086	2,406
March	357	85	3,980	782	11,503	2,632	15,840	3,499
April	344	72	4,469	935	13,078	3,072	17,891	4,079
May	432	74	5,074	1,041	15,672	3,801	21,178	4,916
June	411	71	5,084	906	15,115	3,369	20,610	4,346
July	430	77	5,551	990	16,779	3,682	22,760	4,749
Aug.	457	82	5,408	993	16,238	3,464	22,103	4,539
Sept.	432	70	4,985	865	14,982	2,991	20,399	3,926
Oct.	446	67	4,640	795	13,733	2,694	18,819	3,556
Nov.	445	41	4,775	674	12,817	2,282	18,037	2,997
Dec.	602	56	5,490	652	15,130	2,288	21,222	2,996

BASIC TRAINING COLLEGE BANIPUR

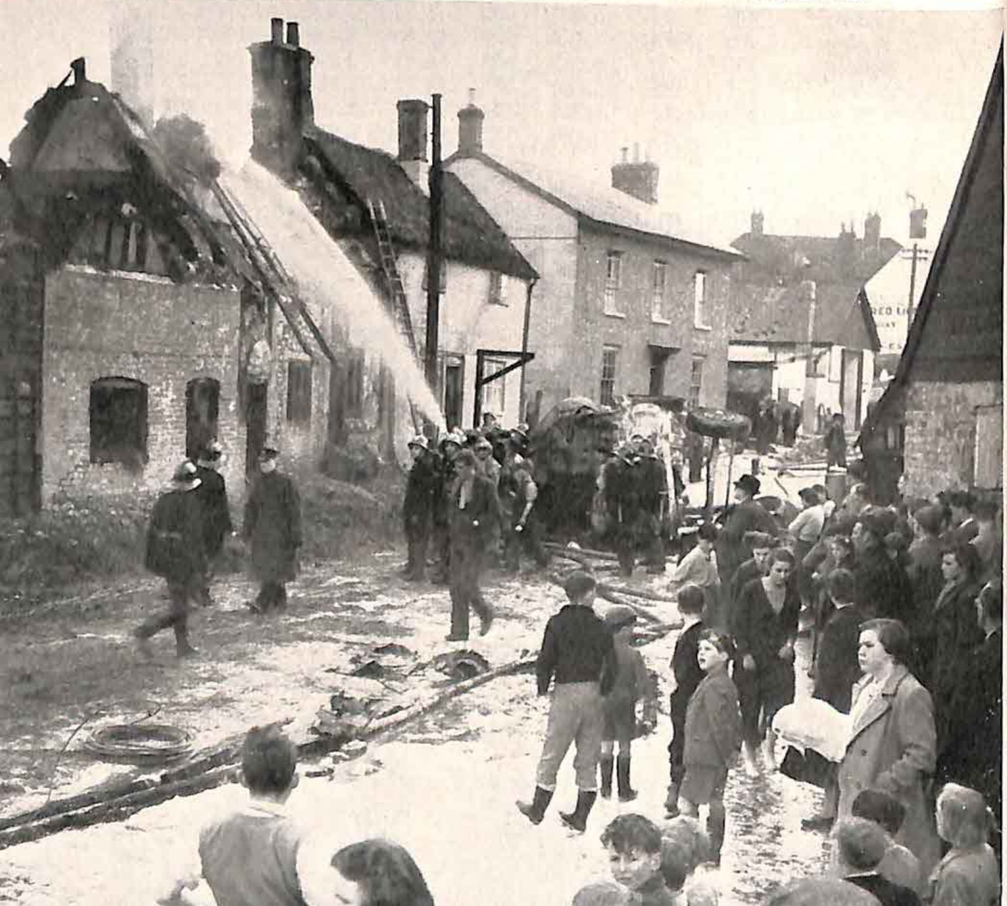
If you live in Great Britain try to find out if the figures today are better or worse than in 1953 and what reasons might help to explain the changes.

Aeroplane accidents. In many ways the worst of modern accidents are those that happen to aeroplanes, as these often involve the death or injury of almost everyone on board. All countries have special laws and tests regarding the safety of aircraft, though these tests are more thorough and more strictly applied in some countries than in others. In addition pilots are selected and trained with very great care. They must have good eyesight, and their muscles must respond quickly to any situation that may arise. Well-trained pilots and good machines have made air travel safe when compared with many other things that we do. But the pilot depends upon the perfect running of his engine and the perfect action of all his controls. *Can you see why it is very important that aeroplane mechanics should be very conscientious and reliable men?*

Accidents in the home. Danger of injury is by no means limited to our outdoor lives. A great many mishaps occur in and around the home. Indeed, generally more people die from accidents in the home than are killed on the roads. In England and Wales more children under fifteen die from accidents in the the home than from any single infectious disease. The commonest danger is that of fire. Every year in

FIGURE 40. This fire was caused by an oil tanker overturning.

Topical Press Agency Ltd.



England and Wales there are about 15,000 fires in people's homes for which the fire brigade has to be called. In most years about 500 people in England and Wales die from fires and about 3,000 are burned, scalded or otherwise injured in fires.

Fires are often caused by faulty apparatus, "shorting" of electric current and similar things. Sometimes they are caused by faulty building construction which allows wooden bearers underneath hearths to get hot and to smoulder and finally to catch fire. With better ideas on building construction this is becoming a less common cause of fire, but it is still important.

Most fires have been caused by carelessness or neglect of ordinary commonsense precautions. For instance in a recent survey it was found that in over 1,000 households where there was an open coal fire alight and children of under six were in the home, *little more than one-third of the houses were using a fireguard.*

In the United Kingdom, by a law passed in 1952, no gas fires, electric fires or oil heaters may be sold which do not provide certain forms of fixed guard. This will help to reduce the number of cases in which the clothing of children or women is set alight by coming into contact with flame or red-hot element. Why does the clothing of men and boys catch alight much less often ?

The table on the next page will show you that while coal fires are the main cause of accidents by fire, electrical equipment causes nearly one fire in five. Electrical equipment can also be the cause of electric shock and of electrocution.

Coal gas quite frequently causes fires, and gas fires and gas stoves can also be the source of home accidents other than by fire. Coal gas contains the poisonous constituent carbon monoxide and if a gas fire is not fully turned off, this poisonous gas gets into the air and may kill people in bedrooms while they are asleep.

Gas is also dangerous in another way—a little of it, mixed with air, makes an explosive mixture and if anyone enters a room where a little gas has become mixed up with the air, and thoughtlessly lights a match, a fierce explosion may take place.

Some of the most common causes of fires in private homes in the United Kingdom.

Cause	Percentage of all fires in private houses	
1. *Electrical equipment :*		
(*a*) Cooker, fire, heater, radiation, iron . . .	7·0	19%
(*b*) Refrigeration, wireless and television . .	5·0	
(*c*) Electric wires and cables	7·0	
2. *Coal gas :* Rings, cookers, fires		7%
3. *Fires in grates :*		
(*a*) Igniting bedding, clothing, etc.	2·8	25%
(*b*) Igniting furniture or furnishings . . .	2·0	
(*c*) Igniting structural timber under hearth .	8·0	
(*d*) Igniting other materials	9·0	
(*e*) Setting chimney on fire to spread to house .	2·6	
4. *Slow-combustion stoves :* Igniting woodwork or other materials . .		4%
5. *Matches*, including children playing with matches		8%
6. *Candles, oil lamps and oil stoves*		4%
7. *Cigarette ends, etc.*		10%
8. *All other causes*		23%

Fortunately gas generally has a strong smell so our noses usually warn us when there is an escape of gas.

Other common causes of accidents are—

A dustpan and brush left on a badly lighted staircase.

A loop of flex across a floor. This may cause someone to trip, or worn insulation may cause an electric shock.

A loose mat on a slippery floor or a loose stair carpet.

A saucepan handle sticking out beyond the edge of a stove. This may cause a child to scald itself very badly.

Down pillows for small babies. If the baby turns over it may suffocate. Indeed many babies die in this way every year.

So you see that many of the accidents that occur could be avoided by a little forethought and care. This would save a tremendous lot of suffering and unhappiness. In fact, if people were all a little more scientific and were to think, as scientists do, what is likely to happen before they act, then we should all find life rather easier and happier.

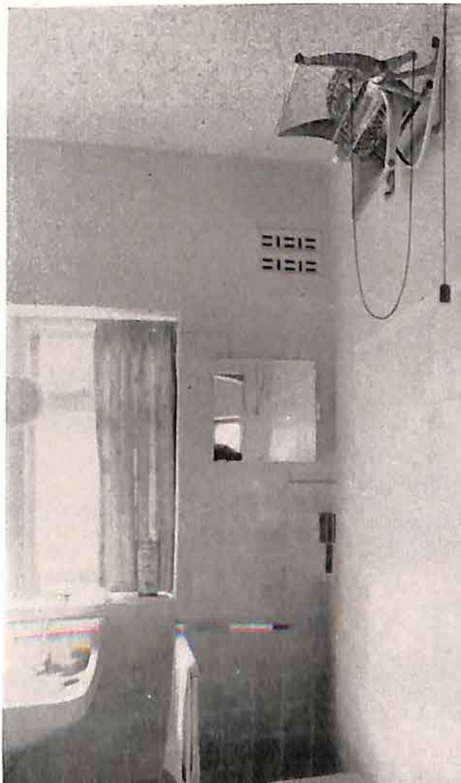


FIGURE 41. Why should an electric fire in a bathroom be mounted high up out of reach? Why is the light switch, too, on a piece of cord?

Courtesy, Electrical Development Association

SOME THINGS YOU MAY CARE TO DO

1. See if you can find the figures for the road accidents in your town or county during the last ten years, preferably for every quarter of the year. Represent them in the form of a graph and discuss with your friends and relatives the reasons for the variation. Do these figures lead you to any conclusions regarding the causes of accidents ?

2. Many scientific inventions have made travel by air far safer than it was twenty years ago, both in good weather and bad, by day and by night. Read up about the subject to give a report to your class on "Safety in the Air."

3. Explain the meaning of each of the following "famous last words" of motor cyclists and car drivers :

"Got a light, George ?"

"Which is the throttle ?"

"Come on, Mabel, there's plenty more room on the carrier."

"Quick, that's our turning."

"Thanks, I can light my own, this car steers itself."

"Look, here's the thousand coming up."

". . . every inch of this road."

"If you brake carefully, worn tyres don't matter a bit."

"You really must look at that sunset."

"No one ever makes *me* dip my headlight."

"As a matter of fact I drive better when I've had a couple."

We are indebted to Messrs. Methuen & Co. Ltd. for permission to reproduce *Famous Last Words* from *You Have Been Warned* by Fougasse and W. D. H. McCullough.

4. Explain the following "famous last words" of cyclists:

"... my foot on the tyre does instead."

"I've never spent a penny on oil."

"... even if it's a bit big for me."

"Look, that's Phyllis over there: wave to her."

"... he's got plenty of road."

"I've ridden bikes for years and never had a light."

"I always cross on the orange."

"These racing bikes are wizard."

"I always go between them."

"No, I can't bother about rules of the road."

5. Explain the following "famous last words" at home:

"I wonder if I ought to have switched off at the main fuse?"

"There's a gas leak here somewhere: lend me a match."

"This cotton frock may be pretty but I get cold in it: let me stand by the fire."

"No, this fire is not too big to leave: anyway I'm going to bed."

"Yes, it's an electric wire, but it's probably only the telephone wire."

"It isn't in a poison bottle and it smells like cough mixture, so here goes."

"I can lean a long way out of windows without falling: just you watch."

"No, I can't smell gas: let's go to sleep."

6. Find out which fabrics are most inflammable by burning a thread of each of the following: wool, cotton, rayon, nylon, linen. Why, if someone's clothes are on fire, is it good to throw a rug round them?

Question 2. **What should be done about Minor Injuries?**

Since you are likely to have some small mishaps no matter how careful you may be, you should know how to care for common injuries. Among them are many minor cuts and burns. In themselves, they are not dangerous, because new cells soon form, and the damaged area heals within a few days if all goes well. There is, however, the possibility that bacteria will get into any kind of wound and cause a lot of trouble. It is for this reason that we put iodine solution upon a cut.

You may be interested to see what an antiseptic like iodine solution will do. If in a jar of water from a pond you have found some single-celled forms of life (as you did in Unit 4, Figure 2) the following experiment can be performed.

Put a few drops of the water containing these organisms on a microscope slide and cover with a cover slip. Put on the stage of a microscope or microprojector, keeping the stage horizontal. Focus until you have quite a number of the organisms in view. Then put a few drops of iodine solution against one edge of the cover slip and a slip of blotting paper with a fresh-cut straight edge against the opposite edge of the cover slip. Allow the blotting paper *slowly* to suck iodine solution into the water below the cover slip. Watch what happens to the moving organisms when they encounter even small amounts of the iodine solution. You will see that most of them are instantaneously killed.

Does the fact that these minute creatures are killed ensure that all bacteria would likewise be killed?

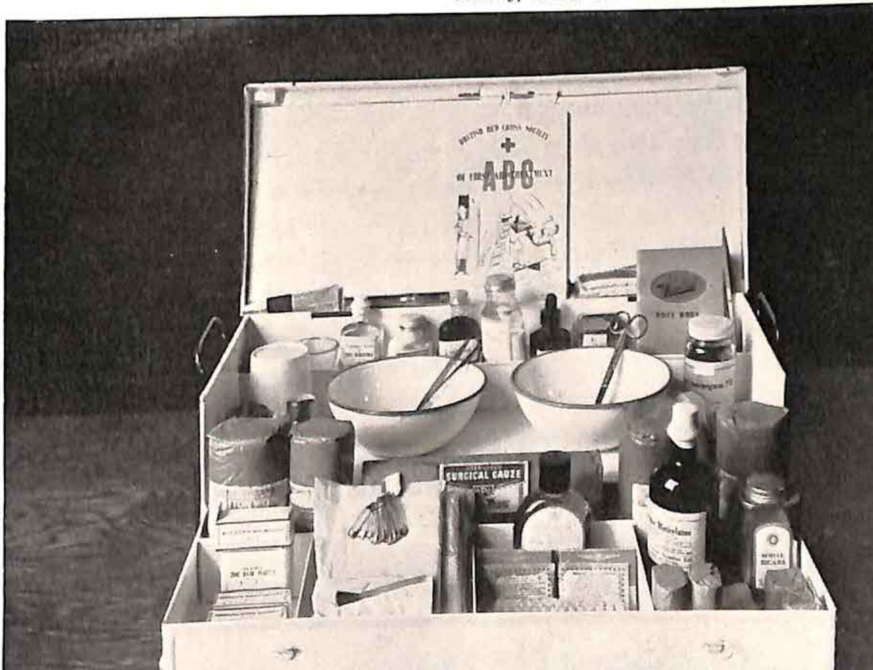
Cuts. Of course the answer to the foregoing question is "No." Some bacteria, as we know, are much harder to kill than the single-celled organisms in pond water. But iodine solution is a good *antiseptic*, and, if properly used, will control most of the bacteria that may have got into a shallow cut. Do you remember what the word antiseptic means?

Most antiseptics, being poisons, are for external use only. They should *never* be swallowed, and should be kept out of the reach of small children, or of anyone who might accidentally drink them as internal medicine. It is a good plan for bottles which contain such poisonous antiseptics to have a different shape or an exterior which *feels* different from a medicine bottle and so can be recognized in the dark. Have you handled such bottles?

When you are treating a cut it is best always to clean the area around by wiping it with a pad of cotton wool soaked in surgical spirit (pure alcohol).

FIGURE 42. A first-aid box.

Courtesy, British Red Cross Society



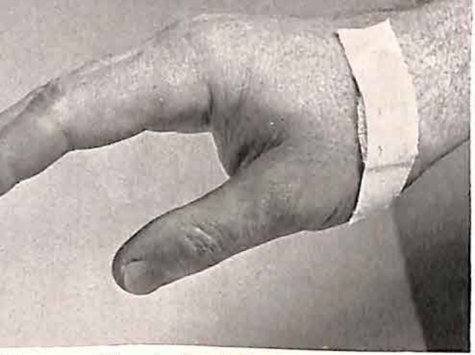


FIGURE 43. A simple bandage for a small cut.

Always wipe from the cut outwards, so that you do not get dirt into the broken tissues. Then the iodine solution is applied to the wound and allowed to dry. Next the injury is covered with a loose bandage of *sterile* gauze. Do you remember what *sterile* means? A gauze bandage can be kept in place by tying the ends together, or an adhesive kind can be used as shown in Figure 43.

Bandages. The main purpose of the bandage is to keep dirt and bacteria from getting into the wound. But it should not be put on too tightly. To do so might interfere with circulation of the blood and keep air from reaching the injury.

Burns. Burns are a different kind of injury and other methods must be used. Deep burns, or those that cover a large expanse of skin, can be very dangerous and call for the services of a doctor. The milder types are limited to a reddening of the skin or a small blistered area. They are uncomfortable, but not likely to be serious unless bacteria develop colonies in places where the skin has been broken. Such burns should not be covered with ordinary ointments, oils, or greases and should not be treated with iodine. If a specially prepared burn dressing is available then that is best. Otherwise apply a loose bandage that has been soaked in a solution made by dissolving four tablespoonfuls of baking soda in a quart of water.

These treatments, we must remember, apply only to small surface burns: more serious burns require different and skilled treatment.

Sunburn. During every holiday season many people suffer discomfort and even serious injury from sunburn. It is like the burn that you get from a hot stove, except that you are sunburned more slowly. Such an unpleasant experience can be avoided if caution is observed. A good method is to begin the summer season with only a short exposure of the skin to the sun's rays. Then increase the time of exposure each day, little by little, so that the skin becomes tanned gradually. Remember that beaches with white sands are likely to be very deceptive. The sand reflects rays of the sun, and a person with a white skin can be badly burned even on what appears to be a dull and somewhat cloudy day.

Insect bites and stings. Some insects *bite*, that is to say they use the specially adapted parts of their mouth to injure us. Such insects are usually blood-suckers, like the mosquito.

Other insects *sting*, that is to say they attack with a weapon. They are not attempting to suck blood: they are merely intent on causing injury to their enemy. Sometimes in so doing they kill themselves. They only attack human beings when they have been annoyed. The best way not to annoy these insects when they are near is to leave them alone and not to get excited.

The chief stinging insects which affect people in Western Europe are bees, wasps and the huge form of wasp called a hornet. The stings cause immediate pain and the area around the sting swells up. Fortunately the poison seldom gets into the general stream of the blood, so the results are seldom serious unless the sting is in the mouth or on the lips.

Generally speaking, wasps do not leave their sting in the wound, but bees do. So if the sting is still present the first step in the treatment is to remove the sting. This can usually be done more easily by pressing the hollow end of a small key over the sting. Sucking the wound and spitting out the fluid helps for quick action.

If you can get methylated spirit it is good to apply this to the area of the sting before giving the main treatment, which is quite different in the cases of bee and wasp.

Vinegar for Wasp:
Bicarbonate for Bee.

The bicarbonate solution used for bee stings is stronger than that used for burns: use a teaspoonful of bicarbonate of soda to a cup of water. Household ammonia solution diluted with four parts of water may be used instead.

If the sting is in the mouth, get a doctor quickly or take the patient to a hospital.

Small objects in the eye. We all, from time to time, get "foreign bodies" in our eye. Dust or sand are probably the commonest of these, especially in dry gusty weather. But eyelashes and small flies are also very common causes of bother. If it is possible to remove the small object fairly quickly this should be done. But one can easily harm the eye by trying too hard to remove the foreign body. So the rule, if simple measures do not succeed fairly quickly, is to put some drops of olive oil or castor oil into the eye to soothe it, put on a loose bandage, and go to a doctor.

Nature's method in trying to remove the object is to flush the eye with tears. So if you get something in your eye, *don't rub it* but blow your nose strongly and blink the eyelid several times.

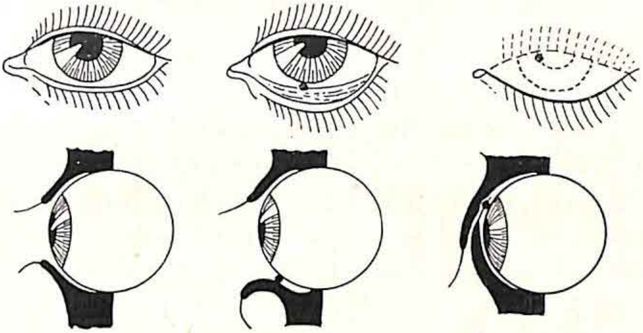


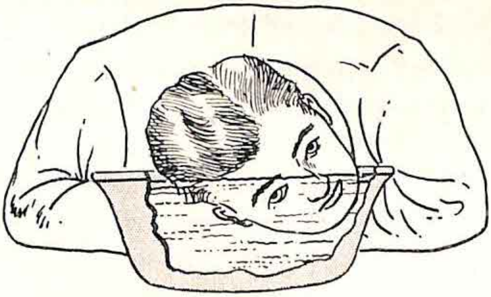
FIGURE 44. Removing a small object from the eye by manipulating the eyelids.

If this does not move the little object get a friend to *turn the lower lid down gently* and, if he can see the thing, to remove it with the corner of a soft handkerchief or with a moistened camel-hair brush.

If the object cannot be seen, the friend should now *pull the upper lid forward* by the eyelashes and gently slide the lower lid under it. This may enable the lashes of the lower lid to move the object if it is under the upper lid.

If this plan does not succeed, submerge your eye in a basin of water, blinking the eyelid frequently. If this fails, then you must get the help of a doctor.

FIGURE 45. Washing out a small object from the eye by blinking the eyelid under water.



SOME THINGS YOU MAY CARE TO DO

1. Exhibit the contents of a first-aid kit (Figure 42), and show the uses of the various items.

2. Learn to make simple bandages that could be used on (*a*) a finger, (*b*) the back of a hand, and (*c*) an arm.

3. Repeat the experiment in which drops of iodine solution are added to single-celled organisms in pond water, but in this case use alcohol instead of iodine.

4. Read up the treatment of burns in a first-aid book such as that of the St. John Ambulance Brigade or the British Red Cross Society. Note that severe burns are always accompanied by shock and that treatment must also be given for this.

5. Prepare a talk on the different kinds of wasp, and where they make their nests. Explain the useful things that wasps do.

6. Prepare a talk on the different kinds of wild bee and their life story. Discuss whether wild bees sting.

7. Ask your librarian to help you find a book containing a diagram of the structure of the eye. Make an enlarged copy of this on drawing paper, marking some of the parts in colour. Label each part clearly.

Problem C: **How can we guard against Accidents?**

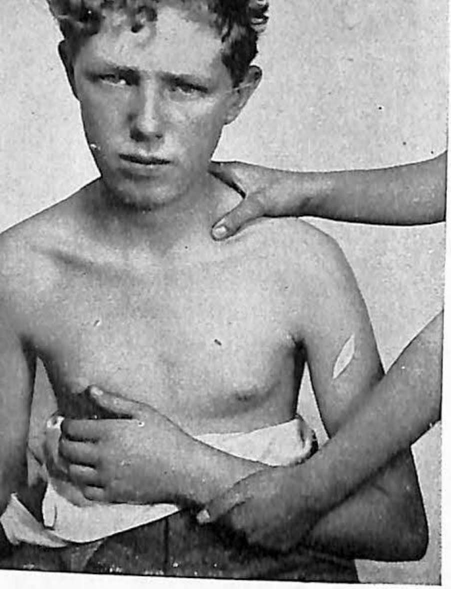
Question 3. **What is First Aid?**

The treatment of minor cuts and burns described in the preceding pages is one type of first aid. In the case of certain more serious injuries, it is sometimes a good idea to do certain things at once, even though a doctor has been called. An example would be what one might do to check rapid bleeding from a wound. Such measures would also be called first aid.

Blood is pumped from the heart through stout-walled yellowish-white tubes which can be compared with rubber hose-pipe in their firmness and elastic nature. You probably know that these big tubes, through which the blood goes pulsing on its journey round the body, are called *arteries*. These branch into smaller tubes which branch into still smaller ones and so on until finally the blood flows through a fine network of tubes thinner than a hair. After supplying the skin and the various organs with the food and the oxygen which the blood brings, these fine tubes join up to form slightly larger ones, and these combine to form still larger ones and so on until we come to veins, which convey the blood back to the heart. But veins and all the other tubes which take the blood *back* to the heart have very thin walls, seeming almost like a colourless skin. Can you guess *why* there is such a difference between the material of which veins are made and that of which arteries are made?

Your guess, if it is right, will explain why a person with a *cut vein* can usually be saved from bleeding to death without much difficulty. Because the blood in the veins is not under great pressure the leak can generally be stopped by putting a clean pad over the wound and tying a bandage pretty firmly around the limb, so as to keep the pad in place. If blood continues to ooze from below the pad, then put another pad on top of the first one and make the bandage rather tighter than the first one. Do not attempt to remove the first pad, for this only allows the blood to flow more freely. If it is a *vein* that has been cut, then this second pad and second tighter bandage can almost always stop the bleeding.

But if an *artery* has been cut, then pads and bandages are not enough, especially if the artery is a big one.



Vera Elkan

FIGURE 46. Stopping bleeding from a wound in the shoulder or upper arm by pressure above the collarbone.

With a cut artery the patient can very rapidly bleed to death, for the blood comes pulsing out in spurts as the heart pumps it along. The bleeding must be stopped in a few minutes or the patient's condition will become serious.

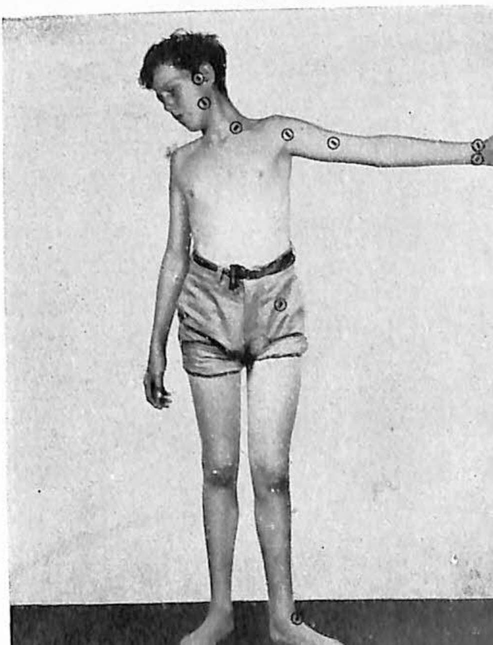
Look at Figure 46. The boy is supposed to have a deep wound, marked white, on the upper part of his left arm. This, it is supposed, has cut the artery and blood is spurting out. You will see that one hand of the First Aid worker is holding the boy's injured arm *up*, so as to slow down the escape of blood. But what is the other hand doing on the boy's neck ? The thumb of the other hand is pressing the artery against a bone beneath and so stopping, or almost stopping, the flow of blood. It is not always easy to do this, because the artery is elastic like hose-pipe and sometimes it may be necessary to press with two thumbs, one on top of the other. But really it is not so much a matter of hand pressure as of knowing where to press. Obviously it is of no use pressing an artery just anywhere, for, if there is only flesh beneath, then the artery is merely pressed deeper into the flesh. We *must* find a spot where a bone lies very near underneath the artery and then we can squeeze the elastic tube against the bone so tightly that the blood cannot get by. These special spots where thumbs can stop the bleeding are known as *pressure points*. Study Figure 47.

First Aid has to be given quickly, especially in a case of bleeding, and while the bleeding is controlled at a pressure point a doctor or ambulance should be summoned.

If such help cannot be obtained for a long time, thumb pressure cannot always be continued long enough, and so a stronger method of pressing on the artery has to be used. This is called the tourniquet method and any First Aid book will tell you how to make a tourniquet. But tourniquets bring great danger with them ; if the blood supply is stopped for more than 15 or 20 minutes the supply may not be able to re-establish itself or infection may develop and the whole limb may eventually have to be removed. So we always try to work on pressure points, and if a tourniquet *has* to be used, we must remember to loosen it a little for a short while every 15 minutes so as to let the flow of blood re-establish itself through the limb. Similarly pressure on pressure points has to be released after 15 minutes, but it is not easy to maintain thumb pressure so long as that. So now look at Figure 47, in which the pressure points are shown by black marks. Then get a friend to find them on you and to see if he can feel the pulse of the blood in the artery beneath when he presses his thumb upon it. Then ask him to be the patient while you practise being the First Aid worker.

FIGURE 47. The black marks indicate the main points where pressure can be applied to stop arterial bleeding.

Vera Elkan



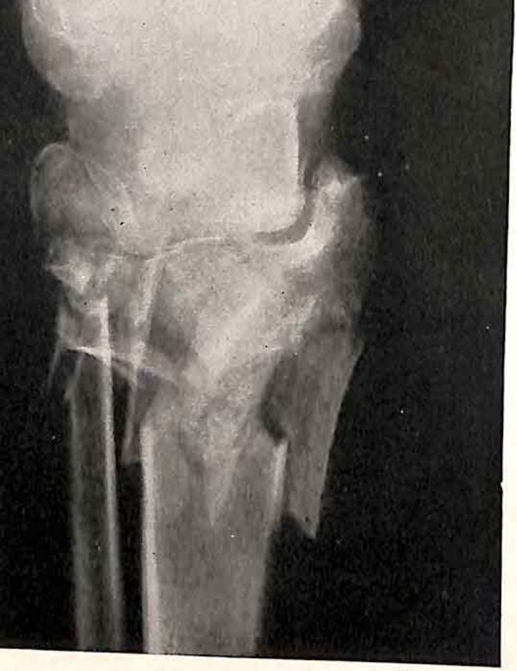


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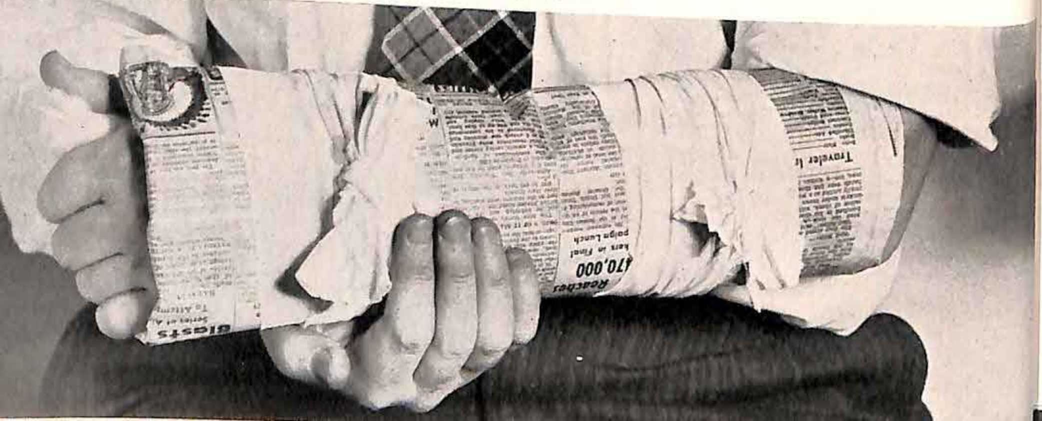
FIGURE 48. An X-ray photograph can show where the bone is broken.

Now look at Figure 48. Here you see a very bad injury to the limb. Jagged pieces of bone, if the limb were moved, might easily cut into veins, arteries and muscles and so cause far greater suffering to the injured person.

So, in the case of a broken bone, do not rush to move the patient. Instead, do everything possible to avoid movement of the damaged limb. Often it becomes necessary to support an arm with splints, so that it can safely be put in a sling. The splints can be a couple of wooden strips, or even newspapers folded lengthwise. These are wrapped with cloth and placed on either side of the injured limb. Then they are tied in place at both ends. Another way is to use a magazine or several newspapers wrapped around an arm as shown in Figure 49. The first-aid worker should never attempt to "set" broken bones. This is a job for the doctor.

FIGURE 49. Support for a fractured forearm, made by using a folded newspaper.



Treatment for shock. Often, when an accident happens, the most important thing that people nearby can do, while the doctor and ambulance are coming, is to treat the injured person for shock.

The degree of shock varies with the person and the nature of the injury. In slight cases the patient may merely seem very talkative or somewhat excited. Or he may be shaking and feel faint. Other signs of shock are whiteness of face and lips, beads of sweat on the forehead, clamminess of the skin, cold hands and feet and rapid or feeble pulse.

The patient, if not already doing so, should be persuaded to lie down until the first stage of shock is over and colour returns to the face. He should be kept warm with blankets, rugs or coats and if he is lying on the ground he must have plenty of wrappings put underneath him to prevent loss of heat to the cold ground. If the legs are not broken it is helpful to raise the feet by a cushion. A hot-water bottle, well wrapped, is also a help.

The rules for first-aid treatment of shock are summarized by the British Red Cross Society in this way:

1. *Lay the patient flat* with head to one side and legs raised about nine inches, provided that they are not injured.
2. *Stop any bleeding.*
3. *Loosen clothing at neck and waist.*
4. *Keep warm*—therefore *do not remove* clothing; wrap round with blankets, rugs, or coats; give hot-water bottles, if available, but do not overheat to the point of sweating.
5. *Handle* as gently as possible and be careful to avoid any unnecessary movements.
6. See there is *plenty of air* and protect against wind, rain, and cold.

7. *Give drinks of hot tea or coffee*, if there is no injury to chest or abdomen.
8. Be *cheerful* and keep the patient cheerful.
9. Get a *doctor or send the patient to hospital* as soon as possible.

These suggestions for dealing with accidents are only plans for first aid, that is to say aid that is given *first*, by the person on the spot when an accident happens. Of course a doctor or ambulance should always be sent for except in the case of the simplest type of injury. But meanwhile the first-aid action may make all the difference between a quick or a long recovery and even the difference between life and death. That is why Scouts and Guides and other groups of young people are proud to prepare themselves to help their fellow human beings when accidents happen. In many schools, all over the world, boys and girls take special courses of first aid and prepare themselves for certificates of the St. John Ambulance Brigade and the Red Cross Society. If your school has not yet started such a course perhaps it is only because it is waiting for some keen members to ask for this sort of activity.

FIGURE 50. This is a Senior Scout wearing an Ambulance Badge. As a Scout he qualified for his First Aid Badge.

A. C. Jeffkins

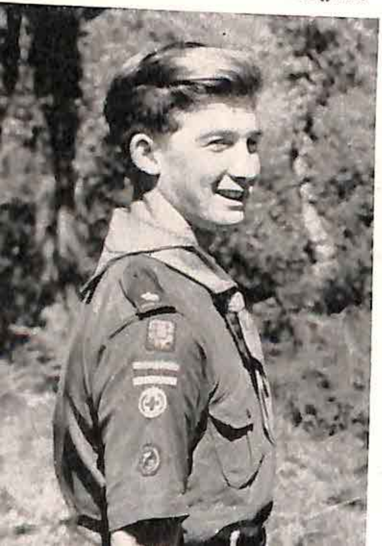
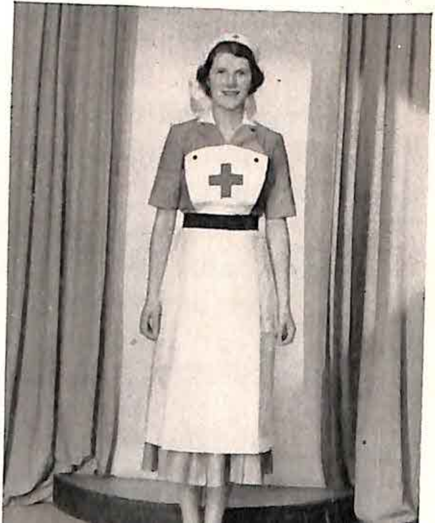


FIGURE 51. Detachment member of the British Red Cross Society wearing her indoor uniform.

Courtesy, British Red Cross Society



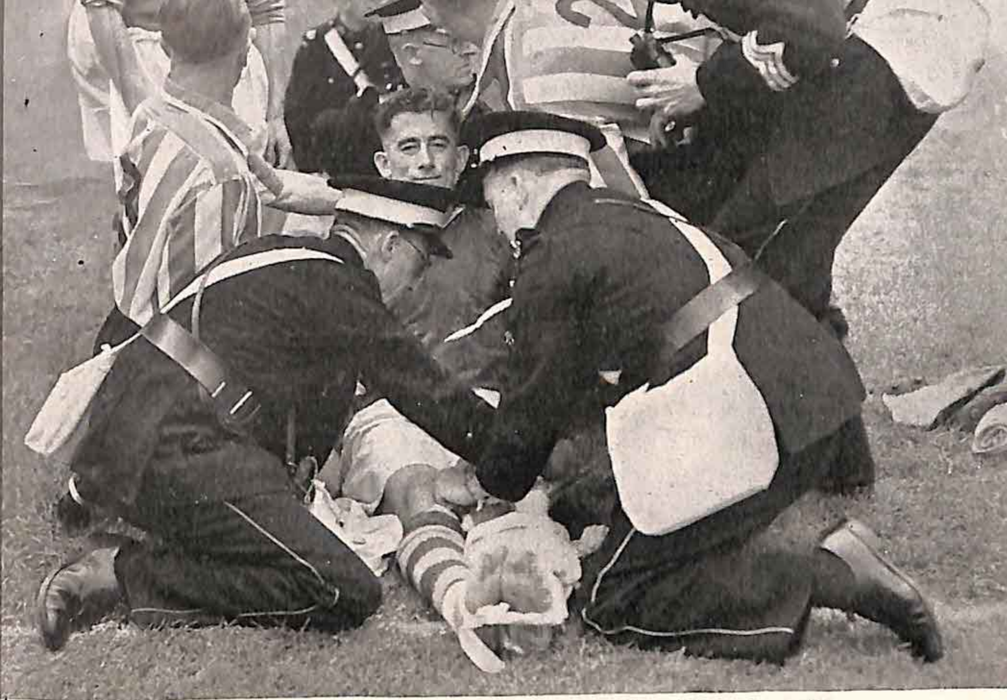


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FIGURE 52. Footballer Stephens, West Ham United centre-forward, receiving first aid from men of the St. John Ambulance Brigade.

SOME THINGS YOU MAY CARE TO DO

All these things can only be done after studying a first-aid handbook such as that of the St. John Ambulance Brigade or the British Red Cross Society. Best of all, try to attend a course of lessons and practical work in First Aid.

1. Draw large diagrams to explain the arteries and veins of the human body. On the diagram of the arteries mark the pressure spots.
2. Learn to make a bandage in which a pressure pad is used over a wound.
3. Learn how to apply artificial respiration. Show how this is done, and be able to explain cases in which the method is useful.
4. Practise the applying of splints for broken bones.

REVIEW QUESTIONS

1. What does the small size of germs have to do with the fact that they are dangerous ?

2. Why were large towns dangerous places in which to live in past centuries ?

3. Are all diseases caused by bacteria ?

4. In what ways can bacteria get into the human body ?

5. What are some defences of the human body against bacteria and viruses ?

6. How are insects concerned with the spread of diseases ? What types of insects are particularly dangerous ?

7. Why are rats dangerous to health ?

8. How can you find out whether or not a person has a fever ?

9. What are two general reasons why it is a good idea to stay in bed if you have a cold ?

10. Why is sneezing dangerous to other people ?

11. How can you explain the fact that all colds do not seem to affect you in the same way ?

12. Why is it a good habit to keep the teeth clean ?

13. What things can be done to protect the eyes and ears ?

14. Why is it desirable that the skin be kept clean ?

15. What are some of the most important causes of road accidents ? How may they be reduced in number ?

16. What are some dangers to be found within the home ? How can they be avoided ?

17. How would you deal with a small cut ? A minor burn ?

18. How could you stop bleeding from a vein ? From an artery ?

19. Why is it unsafe to apply a tourniquet for a long period of time ?

20. How can you help to reduce the effects of shock on someone who has had an accident ?